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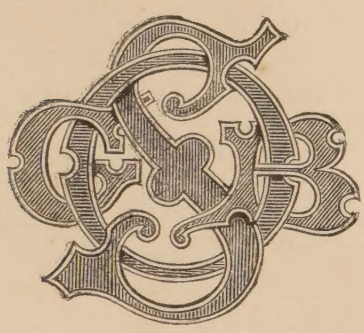

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Errata.

[*The following Name has been inadvertently omitted from the general List of Members.*]

India ..... SCHULTZ, EMIL MARTIN E., Meerut, North-West Provinces.

DE LESSERT, ALFRED ALEX., removed from Wolverhampton to 243A, Union-street, Aberdeen.

GENERAL MONTHLY MEETING,

Monday, November 2, 1868,

JAMES PARKINSON, Esq., President, in the Chair.

The following gentleman was duly elected a Member of the Society:—

Arnold Pitowsky, Esq., Barnstaple. (Non-resident.)

The following gentlemen were proposed for the Membership of the Society:—

F. G. Vanderpant, Esq. (non-resident), and
J. Watson, Esq. (non-resident).

The minutes of the previous meeting were read and confirmed.

The President announced that at the next meeting of the Society the Committee appointed to investigate the merits of the protoxide of nitrogen as an anæsthetic would make their first report.

A book, entitled "Mechanical Treatment of Deformities of the Mouth," by Mr. Ramsay and Mr. J. O. Coles, was presented to the library by the authors.

Mr. Jones, of Brook Street, presented two key instruments to the museum.

The President said this would be a convenient opportunity to inform the Society of a change about to take place in the publication of their proceedings and transactions. The Council considered it very desirable that these should be in the possession of members as shortly after each meeting as practicable, and for that purpose it was proposed, if possible during the current month after each meeting, to issue gratuitously to each member a printed account of such of their

proceedings as might be considered interesting, together with the paper read and the discussions arising thereon, and in such a form that, at the end of each year, they might be bound together into a volume in lieu of the transactions as hitherto issued. By this means they hoped to supply the members with a correct and early account of their monthly meetings, and also place them in more direct communication with the Society. It was a great satisfaction to know that this arrangement met with the entire approval of their late able and esteemed librarian, Mr. Fletcher.

Mr. Norton (of St. Mary's Hospital) introduced to the notice of the Society an instrument for administering nitrous oxide gas. It consisted of a conical mouthpiece, surrounded by an air-pad of india-rubber, causing it to fit closely upon the face. There were two orifices behind the mouthpiece for the admission of air, which, when the iustrument was applied, could be breathed freely before turning on the tap for the admission of the gas, and shut off when necessary. The rest of the instrument simply consisted of the inspiratory and expiratory valves (a modification of Clover's)—one placed in the upper surface of the stem and the other in the cana itself. There was also a tube to be attached to the bag. It was very inexpensive, and worked well. One advantage it possessed over Clover's instrument was, that the gas could be administered perfectly free from air. Besides that, there was no necessity to change the mouthpiece, as it was applicable to almost the smallest child and to any adult; while with the apparatus covering the nose and mouth it was absolutely necessary to have at least three in order to fit different individuals.

Mr. Sewill had seen the gas administered twice with Mr. Norton's apparatus, and could corroborate what had been said as to its advantages. It answered every purpose, and was so simple that no demonstration was required to prove that it must succeed. The only objection that could possibly be raised was that, unless a nose-clamp were used, a second person would be required to hold the patient's nose. He believed that it was desirable to feel the pulse during the time the oxide was inhaled; and if the operator administered the gas, he could

not at the same time hold the patient's nose, and thus a second person would be required. That, however, he considered no disadvantage, because he certainly should not proceed to administer nitrous oxide gas without having an assistant present. They knew so little about the *modus operandi*, and were so much in the dark as to the physiological effects of the gas, that it wa extremely important to have assistance at hand, so that, in the event of the patient becoming asphyxiated, or showing other alarming symptoms, the proper means to restore animation might be promptly and effectually applied.

Mr. COLEMAN suggested that as the Report of the Committee appointed to investigate the merits of this gas was to be brought up at the next meeting, further discussion on the subject might be advantageously postponed until that occasion.

The suggestion meeting with the approval of the Society, the discussion was postponed.

Mr. COLES exhibited some new pattern trays, prepared by Messrs. Ash, which he found rather useful in taking impressions of cleft palate. They were intended to do away with the necessity of gutta-percha, or anything of that description. The metal was continued back so as to carry the plaster into the cleft, and reduce the liability of its breaking in any manner.

Mr. OWEN said he was almost afraid the instrument he had to lay before them might be considered by some a little out of date. Mallet-stopping did not hold the place it occupied a little time ago in the esteem of many; still there could be no doubt that it had advantages in certain cases, though, like many valuable contrivances, its fate had been to receive too high commendation, and too much had been expected of it. In cases of large cavities, where a good deal of force was needed to apply gold effectively, there could be no doubt of the advantage of plugging by percussion. All the instruments hitherto constructed for the purpose had two defects—first, that the direction of the force was always in a direct line through the shaft of the instrument; it was accordingly applicable only to those cavities which were accessible from before backwards; secondly, they required to be removed from the

mouth, and to have a fresh adjustment of the spring-force made, in order to modify the force of the blow. Mr. Tome's instrument was the simplest and most effective he had seen. The action of it did not depend upon any complicated arrangement of levers, springs, and catches, and the intensity of each blow was, as in "the right-angle universal percusser" he held in his hand, perfectly under control, being dependent upon the degree in which the spring is depressed before it is released to deliver the blow. The defect in other instruments of the percussive force being in a direct line through the shaft was overcome in the instrument then exhibited: the plugging bit was held loosely at the extremity of the shaft, and at right angles, and by an arrangement of levers the blow was communicated in that direction also. It could therefore be applied to teeth at the back of the mouth, and to the posterior surfaces of the teeth also, in both the upper and lower jaw. A little practice was necessary in order to use the instrument conveniently, but when that was acquired, it would fully meet the wishes of those operators who were fond of percussive force.

The PRESIDENT announced that Mr. Smale had sent some specimens of perforated platina for vulcanite frames.

Mr. WALKER said he had used perforated platina, and also perforated gold plate, and had brought a specimen to show how beautifully the india-rubber passed through the perforations in the platina. He had more experience with perforated gold than platina; but Mr. Smale told him of many gentlemen who had used the platina extensively for the last five or six weeks and appreciated it very highly. Mr. Walker understood it was Mr. Smale's intention to introduce a similar perforated gold plate.

Mr. SERCOMBE thought it of the utmost importance that the merits of plugging by percussion should be fully investigated. From Mr. Owen's remarks, he inferred that he did not consider it of as great value as at first it was supposed to be; he also further inferred it was considered only useful in large cavities. His own experience led him to demur to both these conclusions. He found it of increasing value, and peculiarly applicable to the most delicate cavities. He was especially interested in this

question, as, as far as he could ascertain, the first time that that mode of stopping, as adopted in America, had been performed in this country, it had been performed in his house, by Dr. McKellops, of St. Louis. His own impression was that it was a principle that would be more widely adopted the more it was understood. That it was felt to be a valuable one was evident from the numerous attempts that had been made by ingenious members of the profession to substitute for the mallet, instruments by which percussion could be given. He would venture to suggest the appointment of a committee to investigate the merits of percussion stopping. He was an advocate for the principle that every new suggestion should be thoroughly, honestly, and fearlessly investigated.

Before sitting down, Mr. SERCOMBE begged permission to say a few words respecting a chair which he saw in the room, exhibited by Messrs. Ash. The chair in question was the invention of Mr. Morrison, a gentleman who had since returned to St. Louis, U.S. He (Mr. Sercombe) considered it absolutely perfect. He had worked with one of his own, with a Perkins, a Betjemann, and one made by Mr. Morrison, which he might describe as the parent of the present one. With this experience of chairs, he thought he might venture to claim, without much boldness, to be in a position to speak of the merits of this chair, having used it constantly for six months; and he had no hesitation in saying it left nothing to be desired. It contains all the movements of value to be found in other chairs, with far greater simplicity in the machinery by which these movements are controlled. It is almost impossible for it to get out of order.

Mr. SERCOMBE was requested by the President to show the various movements of the chair to the Society. At the conclusion, the Society warmly expressed its approval of the mechanism.

The following paper was then read by Mr. LAURIE :—

On Plastic Stoppings.

EARLY in this year I was asked by one of the members of our Society to read a paper on gold-stopping.

So much had been written by eminent authorities on this subject that it appeared to be almost exhausted ; but our aim being to obtain the later experience of practical men in this branch of our art, and receiving a letter of encouragement from our respected President, I felt it a duty as well as a pleasure to prepare a paper as requested.

I must apologize for having altered my original intention. The stopping and preservation of teeth is so extensive a subject that one meagre paper seemed to me little likely to answer the end in view ; and therefore I ask you to accept this as a preliminary paper, intended to promote a friendly discussion and the expression of many opinions on modes of practice.

Although the title of this paper is "Plastic Stoppings," I purpose to exclude gold and tinfoil from our discussion, except for the purpose of comparison, as to durability, with the former metal. At a future time I hope a more elaborate paper will be read by one of our members on gold-stopping exclusively.

I shall limit my observations this evening to the uses of those materials where gold cannot be effectively applied, and shall do so as briefly as possible, that there may be more time for the discussion of the subject before us.

Previous to and since the formation of the Odontological Society, and the founding of dental hospitals in London, our opinions and practice had undergone considerable modification. It is not many years since the medical schools and schools of surgery held that dead teeth ought not to be retained in the mouth. This teaching seemed justified by the frequent occurrence of alveolar abscess and inflammation of the investing membrane and roots of far decayed teeth, after the destruction of the nerve.

The fact must be taken into consideration that in those days patients seldom went to a dentist unless they were in urgent pain, and the means of relief were at that time comparatively unknown; and thus arose the necessity of frequent extraction, as the only remedy. This, in the present day, it is our duty to avoid; and if we can only induce our patients to come to us periodically to have their teeth examined, we then have a fair chance of dealing with them in the early stages of decay. I fear that this paper may appear somewhat like a lecture; and, though I may advocate certain views somewhat strongly, I may state that these views have been gradually

formed, and are, in effect, the result of the experience of other men, combined with my own observations.

I propose first to draw your attention to the milk or deciduous teeth of children, next to the six-year-old molars, and afterwards the subject necessarily becomes more general, in considering what cavities (under certain circumstances) should be filled with plastic stopping in preference to gold-leaf.

Let us first consider the desirability of preserving children's deciduous teeth. This mainly applies to the molars, though sometimes to the canines, but seldom to the other milk teeth. From the fact that these molars are often decayed and painful between the ages of three and six years, when it is obviously undesirable to resort to extraction, we may fairly discuss the best means of preserving them until the time that they would be ejected in the ordinary course of nature. If taken early, before decay has proceeded far, the operation is simple, and perhaps sufficiently well done with amalgam in the ordinary way; but when the decay has gone far, the pressure of food causing pain, it then seems best to remove all the softened bone, and sometimes to extirpate the nerve. This is far more easily done in the first than in the second set, and without the use of powerful irritants, such as arsenious acid, chloride of zinc, potassa fusa, &c.

I have found a great amount of success in allaying irritability both of milk and permanent teeth by using a compound of tannin, carbolic acid, and sometimes an addition of one of the preparations of morphia, and certainly give these combinations a decided preference to arsenious acid or the other irritants before mentioned. The dressing may have to be repeated several times, though more frequently in the permanent teeth.

When the cavities are considered sufficiently prepared for stopping, there are three preparations that may be employed, according to circumstances — Hill's soft stopping, Jacob's gutta-percha, and any good amalgam. I prefer, where amalgam is used, to line the floor and sides of the cavity with Hill's soft stopping, slightly warmed, packing the amalgam as carefully as in ordinary stopping.

Let us next consider the six-year-old molars. We all know how liable these teeth are to early decay, and the great difficulty of preserving them. When taken in time, they can be generally stopped with gold, though sometimes requiring re-stopping, from decay going on underneath or at the side of the original stopping.

The great obstacle to their successful treatment is the fact that they seldom come under the care of the dentist until severe pain has been

experienced, and we may take the approach to this condition as the average of most cases we are called on to treat.

We are all conversant with this condition of these teeth. When pain has commenced without any apparent cavity, the operator easily breaks through a soft disorganized enamel, well known by its opaque whiteness; he then cuts through layer after layer of light brown bone (or dentine) in a softened state: as he nears the nerve cavity, he is warned by the increasing sensitiveness of the tooth that he can go no further with safety. There seem now but two courses to pursue — to extract the tooth, or place in a temporary stopping.

The following treatment has often been found successful:—Prepare the cavity as carefully as possible; then mix a stiff paste composed of tannin, carbolic acid, and one of the precipitates of morphia; dry the cavity, and pass all over its floor and sides a solution of gum mastic and chloroform; then lay on the floor of the cavity some of the tannin preparation with a camel-hair pencil; interpose a non-conductor, on which to pack any good amalgam.

This non-conductor may consist of asbestos, Jacob's gutta-percha stopping, or Hill's soft stopping; if the cavity is deep, or the nerve nearly exposed, a cap may be placed over the pulp cavity. I have seen hippopotamus ivory

used for this purpose, in the shape of an inverted saucer, but prefer vulcanized india-rubber: the latter, being an inorganic substance, is not liable to decay.

I have frequently succeeded in temporarily stopping these teeth by placing on the floor of the nerve cavity a thick layer of asbestos, and filling up with Hill's soft stopping.

Whether the tooth be filled with amalgam or Hill's soft stopping, it must be regarded under these circumstances as only a temporary measure; if all goes well, at some future time the stopping may be cut out, the nerve pulp removed, and the tooth permanently stopped with gold or amalgam, according to its capability of bearing the necessary pressure.

As to the time that must elapse between the temporary and permanent stopping, there can be no rule; the tooth may be tested by hot and cold liquids. Sometimes, after the removal of the temporary stopping, two or three dressings will set it all right.

I think the same course may be followed in the bicuspids, twelve-year-old molars, and wisdom teeth, supposing them to be in the same condition as the teeth just spoken of.

We now come to the cavities in all the teeth, which, from the difficulty of their situation, the sensitiveness of the dentine, or other circumstances, make it more desirable to stop them

with a soft stopping than with gold. Amongst these we may enumerate the posterior surfaces of twelve-year-old molars and wisdom teeth, interstitial cavities generally, and all cases where the forcible pressure necessary for a good gold stopping cannot be brought to bear.

It will be readily admitted that a good amalgam stopping is better than one imperfectly done in gold; therefore it must be good practice, when gold is found untenable, to use other substances.

A society, now extinct, adopted as one of its rules that no dentist should be a member who did not bind himself to exclude the use of amalgam from his practice. I am able to state from certain knowledge that this was a law more honoured in the breach than in the observance. It is much to be regretted that a few in our profession tell their patients that they use nothing but gold for stopping. What would be the condition of many (perhaps not far from half of the teeth we are called on to treat) if gold-leaf were the only substance we could use?

I believe that the statistics of our hospital show that a considerable number of amalgam stoppings are performed most successfully. The plastic stoppings commonly in use are several kinds of amalgam, osteo-plastic enamel by various makers, Jacob's white gutta-percha, and Hill's soft stopping. Sponge and plastic gold I do not propose to include in this paper.

I am desirous to know what is your experience as to the respective durability of gold and other stoppings. I have seen a few gold stoppings about which there is no reason to doubt that they have been done for nearly thirty years. I have also seen amalgam stoppings good after being done twelve or fifteen years.

It is my belief that, if amalgam stoppings are done with great care, they would be nearly as durable as gold stoppings; but I do not on this account recommend amalgam where gold is available.

I will now say a few words on osteo-plastic stopping. It has certainly not answered my expectations in all cases; for where it has been done with great care it appears to have wasted or dissolved by the action of the fluids of the mouth, particularly near the necks of teeth. Still there are many cases in which it has answered well for three years, but I could not safely state a longer time.

I may mention the durability of Hill's soft stopping, having seen several cases (not done by myself) continuing five or six years in the mouth without any apparent wear or abrasion.

Of course there is one drawback in those teeth that approach the front of the mouth, and that is the tendency to discoloration. This is in a great measure obviated by the use of other plastic stoppings than amalgam, such as Jacob's gutta-percha,

or Rostaing's and Roberts's osteo-plastic cement. I have observed that this is particularly the case where the enamel of the teeth is white and chalky, the secretions of the mouth seeming to have the same effect on the stopping as they had on the enamel originally.

I have lately tried some experiments with frail front teeth, by carefully packing in osteo-plastic stopping, and leaving it to become hard, then cutting a cavity of even depth over the whole surface of the stopping, and packing gold or amalgam, as may appear most desirable. When using amalgam, I take care to have the mercury well squeezed out, and the stopping well washed with a strong liquid ammonia or spirits of wine. The amalgam I prefer for the purpose is made by a Mr. Hallam, but I have not been able to procure any for some time.

Some practitioners have told me of a plan of stopping the pulp cavity and far-gone crowns of molars by filling them up to a certain extent with osteo-plastic enamel, letting this harden, and tapping in gold screws, then packing gold-leaf round them and against the walls of the cavity, until the whole crown is filled.

I believe this idea originated from Dr. Dwinelle, who wrote a pamphlet some years ago on the use of Watts's sponge-gold. As nearly as I can recollect, he states that the crown of a strong lower molar being broken off at the margin of the

gum, he tapped gold screws into parts of the solid bone below, and, by carefully packing, reproduced the crown of the tooth with sponge-gold, the whole operation occupying between three and four hours.

I cannot give a favourable opinion of this elaborate class of stoppings, from their exceptional character and the difficulty of proving their durability.

I hoped to have deferred this paper for a month, and am sorry that it is not so complete as I could have wished, through lack of time. Should I have the pleasure, at some future time, of reading another paper in continuation of this subject, I will do my utmost to atone for the unavoidable deficiencies of the present one.

DISCUSSION.

Mr. SEWILL rose to ask a question or two, but before doing so wished to make a remark about some of the observations that had fallen from Mr. Laurie. Mr. Laurie compared the durability of gold with amalgam, and seemed to hold up amalgam in favourable comparison with gold as a filling for teeth, drawing conclusions from data which were entirely uncorroborative of this opinion. If he brought forward a case where an amalgam filling lasted twenty years, it did not follow that a gold filling might not, in a similar case, have lasted forty. He had seen cases where teeth roughly filled by a patient lasted many years. There were many cases of cavities where decay went on to a certain extent and then became spontaneously arrested. No doubt, in such cases, the dentine underwent those changes described by Mr. Tomes, and became

able to resist the further inroads of disease, so that it was no proof of the value of amalgam compared with gold to say that there were a few cases in which it lasted a long time. It was impossible to make an amalgam filling which would not discolour on the surface, and which would not be liable to chemical decomposition. Great error existed on the point of teeth not being able to bear pressure. Teeth in a very delicate state—when the enamel alone remained—could be filled with gold if the pressure were put in the proper direction. Even front teeth with a most delicate shell of enamel could be restored with gold and made sound and perfect. The question Mr. Sewill wished to ask Mr. Laurie was, Did he find that the mixture of carbolic acid, morphia, and tannin had the effect of devitalizing the pulp? These ingredients did not appear to him to be sufficiently powerful for the purpose. He wished further to ask, Was it desirable to apply powerful agents to the pulps of temporary teeth with the object of destroying them? They could never be sure of the state of development of the fang of a temporary tooth. It was generally either in process of formation or of removal, and remained but a short transient period in a perfect state. There was thus commonly a large orifice in the root communicating with the alveolus, and if an escharotic or any substance of that kind were applied to it, its action must spread to the alveolus, and would probably set up inflammation, perhaps involving the death of the developing permanent tooth situated under the fangs of the tooth to which the irritant was applied. He thought it was a decided point in dental practice that the application of escharotics to the pulps of temporary teeth was a thing to be avoided. Perhaps Mr. Laurie would explain more fully the pathological grounds on which he based his treatment, and say whether he thought the mixture mentioned really had the effect of devitalizing the pulp. Mr. Sewill did not say that all temporary teeth with exposed and inflamed pulps were to be extracted. By the application of proper remedies they might be brought into a healthy state. The pulp might be capped and the teeth filled, and thus might remain during their allotted period, capable of performing their important function, mastication.

Mr. TURNER said, if the duration of a stopping for twenty years was no evidence of its value, he wished to know what was evidence, either as to the value of gold or amalgam stoppings.

Mr. SEWILL said the argument that had been used would explain itself if logically expressed. The statement was, that one amalgam filling had lasted twenty years, and thence it was inferred that all other amalgam fillings would endure for the same period. Such a conclusion was manifestly false. A large majority of authenticated instances of a uniform quality in any existing class was required before such quality could safely be predicted of all future members of that class.

Mr. COLES inquired whether a mixture of gold in a fine state of division with mercury had ever been used, or was used to any extent. He had used it in several instances, and the result was exceedingly satisfactory, both from the very slight contraction there was, and also from the excellent colour it maintained in the mouth. Whether experience precluded its use, or had produced no faith in it, he could not say. In reference to capping temporary teeth, he found it an exceedingly useful plan with large pulp cavities to use a piece of quill thoroughly done over with a paste composed of a little water or mastic and tannin. The tannin seemed to absorb any moisture, and on removing it some two years after he found very little offensive smell in the pulp cavity.

The PRESIDENT.—May I ask how you prepared the gold?

Mr. COLES.—It was just some old gold stoppings I broke up and mixed with mercury. They became perfectly hard and of a beautiful colour.

Mr. LAURIE said that, very many years ago, he did use gold and mercury; but it did not keep a better colour than ordinary amalgam, in his experience, as far as he could recollect.

Mr. UNDERWOOD said a plastic stopping that he had seen used by Mr. Thomas Rogers was palladium. It did not discolour the dentine of the teeth, and presented no evidence of its presence excepting the actual surface of the stopping itself, which was a matter of no importance, as it would only be used for back teeth. It made a most efficient and excellent stopping, but required great rapidity in use, as it hardened very quickly.

Mr. Owen thought it was utterly impossible to get a colourless stopping with mercury. He had seen a variety, but never met with an amalgam stopping that was not more or less discoloured, save on the surface, where mastication had affected it, and it had become polished. The truth was, the mercury itself became sulphuretted, and that was an inevitable cause of discoloration. If they wished to get a plastic metallic stopping of any kind which should not discolour, it must be made without mercury—*i.e.*, it must not be an amalgam.

Mr. Moore (of Plymouth) asked, with reference to amalgam stoppings, whether the quantity introduced into many mouths did not frequently cause galvanic action.

Mr. Laurie said his paper seemed to have been in some measure misunderstood. He would use as little amalgam stopping as he could. It did create galvanic action in some mouths. He was only advocating it where they could not use any other material, not in preference to gold or other stoppings by any means.

Mr. Jordan mentioned the case of a patient he met with recently who assured him that the stopping he then took from his tooth, in order to fill its place with another, had been done fully twenty years ago, and it was almost perfectly good then; only a small piece of the wall had broken away.

The President said there was no doubt of the value of amalgam stoppings, and of the immense time they would last. His own impression was, that if they took as much care to prepare a tooth for an amalgam stopping as they did for gold, they would be more durable than they are. They were very frequently used in teeth where very little trouble was taken, either to prepare the cavity or clear the tooth sufficiently of decayed bone.

Mr. Laurie believed the reason amalgam stoppings so often "came to grief" was the careless way in which they were formerly done. His own practice was, after he had prepared and lined the cavity with Hill's soft stopping, or Roberts's osteo-plastic enamel, as he thought proper to do in far-gone teeth, to thoroughly squeeze out the mercury from the amalgam, and wash it with a strong solution of ammonia or spirits of wine. He then packed the amalgam into every part of the cavity over

the lining, filling it up to the surface. After leaving it, to partially harden, for about half an hour, he carefully finished and burnished, and seldom found the stopping ineffectual. No doubt other gentlemen stopped in the same way quite as well as he did.

Mr. SPENCER thought very much depended upon the preparation and shaping of the cavity. Half the amalgam stoppings failed simply because the decayed bone was cut away, and merely a thin wall of enamel left. The amalgam stopping was then put in; and at some future period, on biting a hard crust or piece of bone, the thin wall of enamel broke, and out fell the stopping. But if the enamel were filed down until it assumed the shape of a low blunt wall, the stopping was much more likely to remain in for a lengthened period. He was in hopes more would have been said upon the preparation of the cavity for stopping, as the length of time the stopping would remain in the tooth depended greatly upon such preparation. The question of the *durability* of the material was a matter altogether different. The amalgam did not crumble or break; it simply came out *en masse*, through the failure of the wall of the tooth, either from fracture or from the further progress of decay.

The PRESIDENT agreed with Mr. Spencer that the proper way to get an amalgam stopping to last a sufficient time was to prepare the cavity properly to receive it. He mentioned a case in which the fang of an upper front tooth had been pivoted in the mouth of a gentleman, a surgeon in the East India Company's service, when he first joined it, at the age of twenty-four or twenty-five. He went to India with the pivoted tooth in his mouth, and came back fourteen or fifteen years afterwards with the root decayed and the tooth loose. It appeared that if the root was plugged and the tooth repivoted through the plugging, it might last a few years. He did that for him. He removed the whole of the caries from the root, and filled it with amalgam stopping, perforated the amalgam, and repivoted the tooth. He merely did it, thinking that before his patient returned to India he would devise some other means. However, it was so firm when he went away that he resolved not to interfere with it. On his

return after the period of his service—twenty-four years—the tooth was as firm as when he left England, and so it has remained up to the present time.

Mr. Owen inquired what kind of pin was used.

The President.—A gold pin. Since that time he had re-pivoted several teeth in a similar way.

Mr. Owen.—You have not found the pins to fail?

The President.—Not in the least—if you carefully cover the pin with fine silk, taking great care that it is well covered; then coat it with prepared mastic. I have never found a pin give way.

Mr. Owen said in several instances he had used an iron pin, as the mercury would not act upon that, with very satisfactory results. He recommended that osteo-plastic stoppings should be painted over with collodion the moment they were applied. The patient was thereby enabled to close the mouth, and the moisture did not affect the stopping until it was perfectly hard.

Mr. Hunt (of Yeovil) said that so far back as twenty years ago a lady came to him who was extremely desirous to have something done to her teeth. He found that the six front teeth had been pivoted, and on inquiry learnt they had been done by Mr. Wilson, of Bath. It was necessary to extract them, and he found the roots in very fair condition.

Mr. Vasey said he believed no stopping equalled a gold stopping. They had never had a paper on gold stopping; and he feared it might go forth publicly, so much as they had discussed plastic stoppings from time to time, that they were all entirely in favour of them.

The President.—I should be very sorry if that were the case.

Mr. Underwood said he should regret it if a report went abroad that the Society, or any majority of its members, were distinctly in favour of plastic stoppings in preference to gold; but he saw no reason for such a fear. Mr. Laurie had done good service to the profession by bringing forward his paper. Mr. Laurie was, as far as he (Mr. Underwood) knew, a good gold-stopper, and one who would never use any other material unless obliged. But there were cases, and they need not be alarmed at discussing them, where gold could not be used. It was therefore their duty to investigate what other materials could,

as they were all well aware that there were teeth that must be irretrievably lost without their use, which otherwise could be retained for many years. There was no predisposition on the part of members of that Society in favour of plastic-stoppings; but, as men bound to do their best by their patients, they took into consideration those cases where gold could not be used, and where it was advisable to do all they possibly could to preserve organs so essential as the teeth.

Mr. WALKER said he had peculiar pleasure in listening to Mr. Laurie's paper, because he had treated the subject from a common-sense point of view. Mr. Laurie began by saying his attention would be principally directed to those teeth that were almost past saving. They were therefore prepared to listen to a paper where plastic stoppings would be advocated for teeth with very frail walls and tender pulps. One point that had not been alluded to in the discussion was the way in which Mr. Laurie prepared the walls of his cavity before introducing his metallic plug by strengthening the walls and protecting the tender pulp with Hill's or Jacob's stopping, and occasionally with the osteo-plastic stopping, first of all preparing, as he said, the tender pulp and nerve by a preparation of carbolic acid, morphia, and tannin. He did not mention how frequently he dressed the teeth; but, from conversations with him, he (Mr. Walker) found that he dressed them as many as three times, and sometimes much longer. Having successfully used osteo-plastic in very large cavities before plugging them with gold, he could confidently recommend that plan. It often happened that the authors of papers spoke of special cases instead of ordinary routine practice. Mr. Laurie had taken cases that were met with every day, and endeavoured to produce a friendly discussion by which individual practice might be ascertained. They should therefore appreciate his paper, and need be under no apprehension that the publication of that evening's proceedings would lead any one to suppose that they preferred osteo-plastic stoppings to gold.

Mr. SERCOMBE said they could scarcely estimate the importance of their discussion that evening. The light Mr. Vasey had thrown upon the subject had struck him also. It might

possibly go forth to the world that they had fallen back to the mode of practice adopted many years ago—that of using amalgam stoppings, or, in fact, any material other than gold. Mr. Laurie made a remark—perhaps inadvertently—which he must take exception to. He stated that very nearly half the stoppings put into the mouth were amalgam, or other than gold. He (Mr. Sercombe) did not profess to be more virtuous than his brethren in this matter; but if he stated that one-eighth of his stoppings were amalgam, he was certain he made a very liberal estimate. No material could be relied upon except gold; but, at the same time, there were many cases where it was desirable to use stoppings which would last a short period; and, for a variety of reasons, it might be desirable to use other material than gold. In such cases they were only doing their duty when they made use of other materials, and the value of plastic stoppings was very great. But for it to be supposed by their brethren in the provinces, or foreign countries, that they stopped anything like half the cases coming before them with any other material than gold would be a great slur upon them at the present day. He must certainly enter a protest against the statement that any such proportion of cases were so treated.

Mr. Laurie said teeth were brought to them in such a condition that one-half would be left unstopped if they attempted them all with gold, whilst more teeth would be extracted than need be. There were some teeth they could not stop with gold; and he believed, if they took the average all over the country, amongst town and country practitioners, the estimate of nearly one-half would be nearly correct.

Mr. Jordan, in reply to Mr. Sercombe, said it was far more important that they should do the best they could for their patients than that they should strive to gain a false reputation from their professional brethren or the general public.

Mr. Vanderpant said it would be interesting to know what kind of amalgam Mr. Laurie would advocate. They all knew one amalgam might answer the purpose more perfectly, and a stopping under the same name might not meet the object in view. If a formula were given of a good amalgam, it would be well received by a great number of members.

Mr. SEWILL certainly thought Mr. Laurie's remarks led up to the argument that amalgam was to be preferred to gold in some cases where either material might with propriety be used, and in which, therefore, a comparison between the value of the two materials as fillings might fairly be drawn. He was glad to find other members felt as strongly as himself on the point that gold fillings should not be the exception, but the rule. He could not presume to the experience of many gentlemen present, but thought the cause of gold filling being to some extent slighted in England arose from its not having been universally practised. In America gold filling had been practised for many years. In England former practitioners had not commonly used it, and so it had been perhaps neglected by some later men. He must apologize if he misunderstood the purport of the paper. He felt very strongly on the question that had been discussed, and was glad to find the feeling was shared by other members of the Society.

Mr. UNDERWOOD said if there were any danger of a report getting abroad that the Society was in favour of using any other material than gold in stopping teeth, it would be still more to be deplored if it were supposed it sanctioned the idea that the English dentists were not as competent as their foreign brethren. Some of the best plugs he had ever seen were done by English dentists, and, having seen a considerable amount of practice in his time, he could safely say that the English might challenge comparison with any dentists in the world.

Mr. SEWILL had no intention of reflecting on the work of the present English dentists. They equalled their American brethren in every respect. But it could not be denied that gold was first universally used in America, and therefore his remark held good.

Mr. MUMMERY could not let the matter pass without expressing his hearty concurrence of feeling with Mr. Sercombe and Mr. Underwood in this matter. Mr. Laurie must have been speaking of neglected teeth, when a mouth came to the practitioner that had perhaps been let alone for years, and he could imagine that in such a case it was a question of sacrificing half the diseased teeth or patching them up with amalgam. But when a mouth had been, from an early age, under the

care of a judicious practitioner, he could not conceive that anything like one-half, or more than one-eighth, part of the stoppings were amalgam. They all had numbers of patients who had not a solitary amalgam stopping in their mouths, because they had been taken in early life to the practitioner. A fruitful source of decay arose from the misconception of parents on the subject of the real nature and position of the first permanent molars. He had repeatedly known parents perfectly astonished on being told that the first permanent molar was not a shedding tooth. It was said that they were very liable to decay; but his experience had been that, if they were taken in hand early, they were very often capable of being made as durable as any teeth in the mouth. Plastic stopping had its great uses; but they were the exception. There were often cases in which, rather than lose a tooth, it was better to stop it with amalgam; but if the mouth were watched from childhood, that might usually be prevented. He thought the discoloration of amalgam stopping in those which contained silver was due to the action of the salt of the food on the amalgam converting it into a chloride, the very quality in silver which made it so valuable to the photographer. Some kinds of amalgam expand in hardening, and when the enamel presents a certain angle to the surface of the stopping, the marginal fibres are often split off by the mechanical force.

Mr. Laurie most cordially agreed with Mr. Mummery, who had really explained a great deal of what he (Mr. Laurie) had said. And as to the question of preserving children's six-year-old molars, Mr. Mummery's practice was precisely what his was, and always would be. It was the parents who threw the greatest difficulties in the way. A lady from Sydney last summer brought three of her children to him, and said she would not have their teeth stopped, because the dentists of Sydney never thought of stopping children's teeth until they were twelve years old or upwards.

Mr. Vasey thought Mr. Mummery was in error with respect to chloride of silver, that being white. It was rather the silver that took the sulphuretted hydrogen.

Mr. Mummery said chloride of silver was acted upon by light.

Mr. Owen.—All salts of silver will become discoloured on contact with organic matter.

Mr. Sewill.—But the chloride will not form salts of silver.

Mr. Vidler said he was one of those who strongly advocated saving temporary teeth to the very last, even if it caused the operator a considerable amount of trouble. No pains ought to be spared to save the temporary teeth. The very best mode of stopping the first molar was to prepare it in the usual careful way with carbolic acid, and then fill it with Roberts's os artificiel, and upon that put gold or amalgam. If the patient could bear the pressure, nothing was equal to gold, and then there was no fear of discolouring the tooth. It was very unpleasant to see that every tooth was saved and of good colour, with the exception of the first permanent molar, as was too frequently the case. He strongly advocated the free use of Roberts's os artificiel; the more it was employed, the greater certainty was there of its success. He very rarely had to remove any teeth to which it had been thoroughly well applied.

The President said he should indeed be sorry were it to proceed from this Society that encouragement was given to amalgam in preference to gold fillings. He certainly never understood from Mr. Laurie that he wished either to encourage the use of amalgam, or that he considered it equal to gold: his object was to promote discussion, and endeavour to discover in what the inferiority of amalgam fillings consisted; and no doubt such discussions were very useful. He begged to offer the thanks of the Society to Mr. Laurie for his paper, also to Mr. Jones for his present of two ancient key instruments to their museum, and to Messrs. Ramsay and Coles for the work they had presented.

The Society then adjourned.

ODONTOLOGICAL SOCIETY OF GREAT BRITAIN.

THE Council of this Society has the pleasure of announcing that, through the liberality of the late President, Mr. IBBETSON, it is empowered to offer for competition a Gold Medal, value twenty guineas, for the best original Essay on the following subject:—

THE HISTOLOGICAL STRUCTURE OF THE HUMAN TEETH.

The Essay must be written in the English language, under a motto, and sent—with a *sealed* envelope, superscribed with the same motto, containing the Author's Name and Address—to the President of the Society, 32, Soho-square, London, by the 31st of December, 1869, after which no essay can be received.

The Council does not pledge itself to award the Medal, except for an essay of a certain standard of excellence; and will claim for the Society the right of publishing the successful essay in its Transactions.

The Scientific of all countries are invited to compete for this Medal.

By order,

JOHN DREW,
C. J. FOX, } *Hon. Secs.*

GENERAL MONTHLY MEETING,

Monday, December 7, 1868,

JAMES PARKINSON, Esq., President, in the Chair.

The Minutes of the last Meeting were read and confirmed.

The following gentlemen were duly elected Members of the Society :—

Mr. Frederick W. Mitchell, L.D.S., 8 Percy Place, Clapham Road.

Mr. Edward Byatt West, L.D.S., 30, New Broad Street, City.

Mr. John T. Cunningham, L.D.S., 114, Laurieston Place, Edinburgh.

Mr. William Williamson, L.D.S., Union Street, Aberdeen.

Mr. Morris de Courcy Dickinson, L.D.S., Ripon House, Havelock Road, Hastings.

The following Gentleman was proposed for the Membership of the Society :—

Mr. Francis George Bridgeman, 12, Queen Anne Street, Cavendish Square.

Mr. Hulme (Curator) announced that the Council had purchased for the Museum a human skull, exhibiting the results of Alveolar Abscess and Abnormal Development of the Teeth ; and the Skull of an aged Monkey of the genus Macascus, exhibiting extreme disease and decay of the Teeth.

Mr. Porter, from Messrs. Bell & Co., exhibited his apparatus for making Nitrous Oxide Gas.*

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* A diagram of the apparatus is appended to this paper at page 67. The apparatus may be purchased of Messrs. Bell & Co., 338, Oxford Street.

Messrs. COXETER and SON exhibited Mr. Clover's Facepiece,* with Supplemental Bag and Stopcock and two-way'd Stopcock for the Nitrous Oxide Gas, and Mr. Cattlin's Bag for the direct administration of the compressed gas, with V shaped piece and unions for two bottles.

Mr. MARGETSON of Dewsbury exhibited a new form of Moveable Gag.

This instrument is offered as an improvement on the wood or vulcanite gags, generally used for keeping the mouth open during dental operations under nitrous oxide.

One objection to the ordinary forms of gag seems to be the number of different sizes required to fit all kinds and forms of mouth; but a greater disadvantage is, that the mouth must be kept widely distended until, on consciousness returning, the gag can be voluntarily removed.

The instrument can be placed between the upper and lower teeth, and extended or shortened without removing it from the mouth; and as soon as the operation is over, if the spring catch is pressed, the upper part of the gag drops, and it can be at once taken out of the mouth without waiting for the co-operation of the patient.

The instrument has been made by Messrs. Coxeter, Grafton Street.

Mr. CLOVER exhibited a new form of Gag.

Mr. JORDAN exhibited the Model of a Gasometer.

Mr. RUTTERFORD exhibited Sprague's Apparatus.

PROTOXIDE OF NITROGEN AS AN ANÆSTHETIC.

The PRESIDENT thought it might be of some advantage if, before the reading of the Report of the Committee appointed to investigate the merits of nitrous oxide as an anæsthetic agent, he briefly explained their object in now bringing it before the profession. It would be recollected that Dr. T. W. Evans, of Paris, in March last, at the Dental Hospital of London, drew the attention of the profession of England to

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* Illustrated at the end of this paper (page 69).

nitrous oxide as an anæsthetic agent. Afterwards, in a letter addressed to himself as President of this Society, the contents of which he had the pleasure of communicating to them at the time, Dr. Evans offered to the Dental Hospital of London a handsome donation to defray the expense of further testing its properties as an anæsthetic agent. There were various claimants to the honour of first using nitrous oxide as an anæsthetic; but to Dr. Evans was undoubtedly due its introduction and successful administration in this metropolis. It was their pleasure to appoint a Committee to act conjointly with a Committee to be appointed from the staff of the Dental Hospital to carry out Dr. Evans's suggestion. That Committee, owing to the short time placed at its disposal, had prepared a somewhat hurried report, but knowing the anxiety of the profession to receive as full, early, and accurate information as possible, had furnished what he must beg the gentlemen present to accept as a purely preliminary one. The Committee however looked forward, at no distant period, to present them with a more comprehensive account of its investigations.

Mr. Harrison then read the Report, which was as follows:—

First Report *of the Joint Committee appointed by the Odontological Society of Great Britain, and the Committee of Management of the Dental Hospital of London, to inquire into the "Value and Advantages of the Protoxide of Nitrogen as an Anæsthetic in Surgical Operations."*

Introduction.

The protoxide of nitrogen was introduced to the notice of the profession in this country, as a valuable and desirable anæsthetic in surgical operations, by Dr. T. W. Evans, of Paris; and

was first successfully used as such, in England, at the Dental Hospital of London, on the 31st of March, 1868; on which day Dr. Evans administered this gas to several patients, at that institution, and subsequently elsewhere, when the operations performed under its use proved so satisfactory as at once to cause it to excite the attention of the medical profession generally.

Shortly after this, Dr. Evans placed at the disposal of the Committee of Management of the Dental Hospital of London the liberal gift of £100, to be expended on experiments to test the value of this gas as an anæsthetic, and in the continued use of it at the hospital, should these experiments realize the expectations he entertained of its value as such; or, should they fail to do this, to test the relative value of any other anæsthetics they might choose.

This led to the appointment, by the Committee of Management of the Dental Hospital of London, of a Sub-committee of its members for this purpose, to act in conjunction with a Committee previously appointed by the Odontological Society of Great Britain, to carry out a similar investigation; and the Joint Committee thus formed, having had eight months' experience in the use of the gas, propose now to present to their respective constituents, through this Report, the result of their labours; but, in doing so, would wish to press upon both the necessity of con-

sidering this as a purely *preliminary* Report, as they are fully aware that their experience must extend over as many thousands as it now does hundreds of cases, before they can venture to give decided opinions on all the points for consideration embraced in this subject.

The Committee have thought it due to Dr. Evans, before entering upon the immediate object of their Report, to record the facts just stated; and beg to express here their sense of the obligation which the profession at large owe him for having so introduced this gas to their notice, and which the Committee of Management of the Dental Hospital of London, in particular, owe him for his very liberal donation to aid them in carrying out these investigations.

Report.

Your Committee, in proceeding to carry out the inquiry entrusted to them, were of opinion that the subject presented itself for consideration under the following heads :—

1st. To ascertain how far this agent *was* an efficient anæsthetic ;

2nd. If so, whether it was as safe, or a safer anæsthetic than those in general use ;

3rd. What were its special advantages and disadvantages as compared with other anæsthetics ;

4th. To ascertain, if possible, how it produced its anæsthetic effect, with a view to devise the best probable remedy, or

remedies, for any alarming or dangerous symptoms that might arise during its exhibition;

5th. To ascertain the best, most convenient, and cheapest method of procuring the gas in a pure state;

6th. The safest and most convenient method of administering the gas;

7th. Whether there were any special conditions of the system, any given age, &c., which would contra-indicate its use; and,

Lastly. To collect and tabulate as many cases and facts as possible, so as to arrive at as full conclusions on these various points as could be arrived at, within the time they had allotted to themselves before making their first report.

Pursuing this plan as fully as circumstances permitted, your Committee first instituted a number of experiments on the lower animals (including dogs, cats, rabbits, guinea-pigs, mice, and birds), from which they at once ascertained,—

1st. That the pure gas, so administered as to preclude the inhaling of any atmospheric air with it, *was* a powerful anæsthetic—more rapid in its action, although more evanescent in its effects, than chloroform and the other anæsthetics then in general use;

2nd. That if its administration were pushed beyond a certain point, it was capable of producing death; but,

3rd. That even when death appeared most imminent from its use, the allowing the animal to breathe fresh air, in most cases, brought it rapidly round.

With this information, obtained from their experiments on the lower animals, your Committee proceeded to avail themselves, cautiously, of the opportunities afforded them at the Dental Hospital of London, and other hospitals, and of such op-

portunities as they respectively had in private practice, to carry on their observations of the effects of the gas, when exhibited to the human being, *pari passu*, with further experiments and observations on the lower animals; and, although they are not yet prepared to offer to the members of the Odontological Society, and the Committee of Management of the Dental Hospital of London, definite opinions as to the effect of this agent, under *all* the heads of investigation which they have just enumerated, they beg now to offer to both those bodies, in this as a preliminary Report, certain facts connected with the exhibition of this agent (the result of their observations *thus far*), which they think will prove interesting and advantageous to the profession in a practical point of view, as forming some guide for its safe exhibition, and for determining the class of cases for which they think it peculiarly suited.

Your Committee have arrived at the conclusion, from their various observations of the effects of this gas when exhibited to the human being, and especially from their experiments with it upon the lower animals, that, properly administered, it is at least as safe and efficient an anæsthetic for short operations as any other now in use; but that, while it possesses certain advantages over these other anæsthetics for such operations, it labours also under certain disadvantages when compared with them for the longer operations in

surgery, and for some other special reasons which they subjoin.

The following are what they consider to be its comparative advantages and disadvantages :—

Advantages.

1. The rapidity of its action in producing anæsthesia ; the time required for this being, according to Table I., which will be found at page 45 of this Report, from 63 to 81 seconds.

2. The rapidity with which patients recover from its effects, as an anæsthetic ; the time required for this being, according to the same table, from 100 to 120 seconds ; and patients generally recovering *so completely*, as well as quickly, as to be able to walk, speak correctly, and write with a steady hand, within four minutes from the commencement of inhalation.

3. It is more agreeable to most patients, being, when pure, quite tasteless.

4. It is less irritating to the air-passages ; coughing or struggling for free respiration being rarely witnessed after its use, except in cases of very nervous persons.

5. The comparative freedom from nausea and vomiting after its use ; the average number of cases where actual vomiting has occurred being under one per cent.

6. The absence, as a general rule (after the recovery of complete consciousness), of giddiness, headache, and many other unpleasant effects, which are well known to follow the use of chloroform and other anæsthetics.

Disadvantages.

1. Its unsuitableness for long operations, owing to the shortness of its anæsthetic effects.

2. Its unsuitableness (or at any rate ineligibility) for operations followed by much smarting and pain, for the same reason.

3. Where very delicate operations have to be performed, the inconvenience to the operator arising from the muscular twitchings which often occur from its use.

4. This gas is more troublesome to administer, and requires more complicated and cumbrous apparatus than other anæsthetics do.

5. The inconvenience arising from the trouble of transporting this gas, as compared with other anæsthetics.

6. Its expensiveness, and the difficulty of procuring it in a pure and efficient state for use at all times, if wanted on an emergency.*

The grounds on which your Committee have arrived at these conclusions are founded on the tabulated results of 1,380 cases in which the effects of the administration of this agent have been carefully watched and noted down by its different members, both in public and private practice; and on the tabulated results also of 1,051 cases reported to them by practitioners of reliable authority, who have used it in London and the provinces; and they offer these opinions, therefore, to the Society with considerable confidence, so far as conclusions can be arrived at from this comparatively limited number of cases.

With regard to the manner in which this gas produces its anæsthetic effect, this is a physiological problem on which your Committee do not feel themselves yet in a position to give any positive opinion. But the result of their experiments on the lower animals would lead them to recommend the following course to be adopted in case any

* The Committee are of opinion that these latter objections will be met and overcome, probably, after a short time, should this agent come largely into use.

alarming symptoms should arise during its administration :—

Treatment under Alarming Symptoms.

1st. The immediate withdrawal of the gas, and the access of fresh air.

2nd. If this is not at once followed by respiratory movements, resorting to artificial respiration in the usual way.

With respect to the best method of procuring a perfectly pure gas (if members prefer, or are obliged from circumstances to manufacture it for themselves), your Committee, having had the valuable assistance of Messrs. John Bell & Co., in aiding them to arrive at a conclusion on this point, would recommend the following :—

Preparation of the Gas.

Take about 4 lbs. of the crystallized, or $3\frac{1}{2}$ lbs. of the granulated, nitrate of ammonia—in either case the salt should be free from impurities *—and put the same into a retort or flask of German glass, thin and round at the bottom, and of the capacity of about 60 ounces. This flask should be provided

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* For ascertaining whether the salt be pure, the following simple tests may be employed. 1st. Take 2 grs. of the salt, and dissolve it in half a drachm of distilled water in a test-tube ; to this solution add, drop by drop, a small quantity of one containing 4 grs. of nitrate of silver in a drachm of distilled water. A light cloud and curdy deposit will indicate the presence of chlorides. 2nd. To a similar solution of the nitrate of ammonia as above described, add a small quantity of one composed of 6 grs. of chloride of barium in a drachm of distilled water. A white cloud will indicate the presence of carbonates or sulphates. These test solutions may be preserved for future use.

with an india-rubber cork, perforated for a glass tube of an internal diameter of half an inch, and bent at an acute angle. The free extremity of the retort, or glass tube, should be connected with the following purifying apparatus. 1. A Woulfe's bottle with three necks, the first of which is connected with the retort or tube just mentioned; the second or middle neck with a common safety tube, or Sprague's or Porter's gas regulator; and the third connected by a glass tube to a second bottle.

The second bottle should contain water, under the surface of which the tube from the first should dip; and another tube, not dipping under the surface, should connect it with a third bottle, and dip under the fluid contained in it. This fluid should consist of a solution of protosulphate of iron (one part of the salt to eight of water), and will prevent any of the higher oxides of nitrogen passing over, if any be formed owing to the temperature applied to the retort or flask being raised too high. A fourth bottle, connected with the third as the latter is with the second, should contain a solution of soda or potash (British Pharmacopœa strength). This will arrest any carbonic acid or chlorine, should any be present in the salt employed.

When the apparatus, as described, is connected together, heat, by means of a gas lamp, should be cautiously applied to the retort or flask, when the nitrate of ammonia (after first melting) will soon enter into a condition of ebullition, and, at a temperature of from 340° Fahr. to 480° Fahr., give off the gas. When the gas issuing from the fourth bottle will ignite the spark of a just extinguished taper, the apparatus should be connected with a gas holder, and the gas collected. The quantity of the salt here employed will yield 84 gallons, or about 14 cubic feet.

The gas holder is best constructed of sheet zinc, strengthened, and should be upon the same principle as an ordinary gasometer (so called), and have at the bottom a case of the same metal, showing as small a quantity and surface of water as possible. Another method of storing the gas is that of compressing it into wrought-iron bottles, as is done by Mr. Barth. Into a bottle of rather a larger capacity than a quart 15

gallons of the gas is compressed. This is a very convenient plan when transit of the gas is required.

Dr. Evans has employed the gas compressed into the liquid form in an aluminium bronze bottle; but, although this is the most convenient form for transporting the agent, the enormous pressure required (viz., thirty atmospheres), and the difficulties and dangers attendant upon the same, will probably prevent its being generally employed in this form. In either of the latter plans it is necessary to liberate the gas into a bag, or gas holder, when employing it. In no case should gas be employed which has not stood over water for some hours.

With regard to the best apparatus for administering the gas, your Committee feel that there will probably always be, as there now is, a difference of opinion on this point; but, after having seen several tried, would recommend that introduced by Mr. Clover, which is a slight modification of his well-known apparatus for administering chloroform. Whatever may be the apparatus used, however, they beg to impress upon the administrator that it is absolutely necessary, for the production of the perfect anæsthetic effect of the gas, that it should be so constructed as entirely to prevent the inhalation of any atmospheric air during its administration.*

With respect to the best and safest mode of exhibiting this gas—the apparatus being chosen,

* Mr. HARRISON here announced that there were several kinds of apparatus for administering the gas (including Mr. Clover's) in the room; and that the gentlemen who had invented them would be happy to explain their respective supposed advantages, either during, or after any discussion that might follow the reading of the Report, if requested to do so.

your Committee would recommend the following plan, (some parts of the directions in which, it will be observed, apply particularly to Mr. Clover's apparatus); and they would especially draw the attention of the profession to the symptoms to be expected during its administration—to be watched—and, when alarming, to be guarded against, which are therein enumerated:—

Mode of Administration, etc.

The counterpoise of the gasholder (if the agent be administered from one) should be removed, so as to assist the passage of gas along the supply tube.

The patient being placed in a good light, and on a chair constructed for supporting the head so that it cannot easily slip, and the dress if tight loosened, the operator should examine the mouth and determine upon what teeth are to be removed. This being done, and the operator having arranged the head-piece of the chair in a convenient position for the operation, and selected and arranged the instruments to be used, so that no time may be lost when the patient is ready for the operation,* a gag should be placed between the jaws to keep them apart.

The gag should have a string attached to it, and be placed, if possible, between sound teeth—the further back, as a general rule, the better, as thus greater space is secured for the operator; but, as some patients commence retching if it is placed very far back—upon the wisdom teeth for example—it is generally best to place it between the second or the first molars, as circumstances may permit, on the side opposite the tooth or teeth to be removed.

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* These directions, *mutatis mutandis*, will apply to the preparation for any surgical operation to be performed under the use of this gas.

The gag may be placed between the incisors, when a molar on both sides is condemned; but, as a caution, it may be stated that a patient, with projecting incisors, is reported to have bitten so firmly against a gag placed between them, that two of them were forced out.

The patient should now be directed to hold the gag with his teeth gently, and the face-piece applied. Whilst this is being adjusted, the patient breathes air only; but by turning the proper stopcock the air is shut off, and the gas is turned on. If Mr. Clover's apparatus be used, the supplemental bag, which is suspended to it, should be shut off until free breathing has removed the residual air from the lungs.

The patient should now be encouraged to take long breaths; for if he holds his breath through fear, he generally makes some sign of discomfort; but if he breathes freely this is not the case.

In from fifteen to twenty seconds the face may be expected to assume a dusky appearance; but the patient is usually conscious for from thirty to forty seconds. In about from forty-five to sixty seconds a further change may be expected to occur rather suddenly. The eyes lose their expression—move unequally, so as occasionally to cause squinting—and the pupil generally becomes somewhat dilated. At this time the eyelids would contract if the conjunctiva were touched; but, if only one tooth is to be extracted, and that not a difficult one, the operation may be performed. If, however, several teeth have to be removed, the inhalation should be continued, although convulsive movements of the hands for ten or fifteen seconds longer may be expected to come on at this time. The pulse then becomes generally weaker, and the breathing stertorous, slower, and intermitting. The inhalation must now be stopped immediately, and the extractions proceeded with. *The pulse and breathing should both be watched carefully at this stage of the administration, and, on the failing of either of them, air should be supplied.* If it is desired to prolong the insensibility (no untoward symptoms having come on), this can be done by covering the nose with a cap fitted to the supply tube, instead of the face-piece.

It is important to place the patient so that he cannot easily

slip off the chair, as patients sometimes have a fit of tetanic spasm, as they are falling under the effects of the gas; and the body is arched as in opisthotonos, so that its weight is supported on the occiput and back of the thighs only, and may slip if this precaution be not taken.

When the condemned teeth are removed, the head should be held forward so as to allow the blood to escape through the mouth; but the gag should not be removed until the consciousness is restored. Generally, patients recover in the most satisfactory manner who are not spoken to until they show signs of consciousness. The attempt to awake them from their dream is attended with no advantage; and a patient disposed to be hysterical is made worse by the exhibition of any anxiety, or even of special interest on the part of the bystanders.

The lips, which are very rarely other than livid, on removing the face-piece, will be found often to assume their natural colour, or rather a brighter colour than natural, by the time the operation is finished.

In hospital practice there are fewer cases requiring the removal of a large number of teeth, at a sitting, than happens often in private practice, where frequently several have to make way for artificial teeth. The number which may be removed after one inhalation of this gas is limited, *necessarily*, only by the recovery of the patient from the state of anæsthesia. But the sockets from which loose teeth have been removed often bleed so freely, and the accumulation of a large quantity of blood in the pharynx would add so much to the danger of any exceptional case of faintness, or interrupted breathing, that the Committee would recommend that the extractions should not be continued beyond a limited number, where the bleeding is abundant, even if the unconsciousness continues; as the fact that patients generally do not object to take the gas several times at a sitting, and that its administration may be repeated, takes away all excuse for running any such risk.

Finally, if alarming symptoms come on, in spite of the precautions here recommended, artificial respiration should be resorted to as already recommended.

As regards the question, "Whether there are any special conditions of the system, any given age, temperament, constitutional derangement, &c., which contra-indicate the use of this gas," your Committee have to state that, so far as their present experience goes, they have met with nothing to absolutely contra-indicate its use—having administered it to both sexes, at all ages, from one to sixty-six years, to patients of all temperaments, to women in different stages of pregnancy and suckling, to persons acknowledged to be the subjects of asthma, epilepsy, &c., and to persons labouring under many other constitutional derangements, without any ill effects following; but they would, nevertheless, recommend great caution in its administration to persons suffering, or presumed to be suffering, from organic diseases of the brain, heart, arteries, lungs, &c.; and to persons of very plethoric habit and short neck, such as would be considered especially likely to be injured by venous congestion about the head, even where no organic disease was supposed to exist. They throw out this precautionary advice, not because they have as yet seen any untoward symptoms arise in such cases (although they have exhibited the gas in several such), but because they are of opinion that it would be in such cases, if in any, that untoward symptoms would be likely to arise from its exhibition.

Lastly, with reference to the various heads

under which your Committee have considered this subject, they would direct the attention of the Society to the following tabulated results of their combined observations, as being interesting in themselves, and of some practical importance in guiding the profession in the administration of this gas.

TABLE I.

Average time required to produce Anæsthesia.	Average duration of Anæsthesia.	Average time from commencement of administration to complete recovery.
Males . . 81 seconds.	24 seconds.	115 seconds.
Females . 76 „	28 „	120 „
Children of 15 years and under 63 „	22 „	100 „

From this table it will be seen that children are the most readily affected by the gas, that they remain for the shortest time under its influence, and that they recover the most quickly from its effects ; whilst females, although more quickly influenced than men, remain longer in a state of anæsthesia, and take more time to recover from the effects of the gas. The time required for producing anæsthesia, its duration, and the time required for recovery, in each class of cases, will also at once be seen from it.

TABLE II.

Ages of the Patients to whom the gas was administered.	Males.	Females.
Under 10 years of age	4	10
Between 10 and 20	124	169
„ 20 „ 30	144	225
„ 30 „ 40	47	48
„ 40 „ 50	17	17
„ 50 „ 60	4	2
„ 60 „ 70	2	1
	342	472

Males 342
Females . . . 472

TOTAL . . 814, being the number, sexes, and ages of the cases from which Table I. is formed.

In drawing up this Report, your Committee have purposely avoided, thus far, making any reference to the very large number of cases stated to have been treated under the action of this gas in America (now said to amount to upwards of 200,000 with the occurrence of but one death,—and that in a patient who was suffering from extensive disease of both lungs; and they have also purposely avoided referring to a large number of cases which have been treated under its action on the Continent of Europe. This was, because they had no *special data* connected with these cases on which they could form

particular calculations, or from which they could draw any special inference, or inferences, unless it were one—but that an important one—viz., that this gas must, with this large mass of evidence in its favour, be regarded as a very safe anæsthetic. They cannot, however, close their Report without drawing the attention of the profession to the very favourable statements regarding its efficiency and safety, as an anæsthetic, which have been received from both these sources.

Your Committee think it right, also, to record here their great and special obligations to Dr. G. Q. Colton, of New York (to whom is due the merit of having re-introduced this gas into use in America, and who must undoubtedly be considered to have had the largest experience of its use of any man living), for much valuable information communicated to them by him, during two visits he paid to London last summer; when, on both occasions, he administered this gas frequently at the Dental Hospital in London, and freely and willingly communicated to your Committee, and the medical officers of that Institution, the results of his large experience of its use.

In conclusion, your Committee beg to state that they have added, as an Appendix to this Report, the result of their observations in certain peculiar cases in which this agent has been administered, and of certain peculiar effects produced by it in other cases (put together without

any special arrangement), considering that these details would prove both interesting and instructive to the profession at large; and they venture to express their hope that, in bringing the result of their experiments and observations on this subject, thus far, before the members of the Odontological Society, and the Committee of Management of the Dental Hospital, in the manner they have now done, they will be considered to have laid before both these bodies some valuable as well as interesting information, which will meet the requirements of the profession pending the prosecution of further experiments and observations which they purpose making on this subject, and hope to lay before them at some future time.

(Signed) W. A. HARRISON,
Chairman.

Appendix.

The Protoxide of Nitrogen has been administered 1,380 times by the medical officers of the Dental Hospital, and Table No. II., contained in the Report, shows the relative ages of 814 of these cases. From this table it appears that the proportion of females to males was about 4 to 3. In 100 protracted and difficult operations it was necessary to give the gas more than once at the same sitting.

It was administered a second time to 100 patients.

,,	,,	third	,,	36	,,
,,	,,	fourth	,,	11	,,
,,	,,	fifth	,,	2	,,
,,	,,	sixth	,,	1	,,

The quickest anæsthetic effect recorded is one of twenty-five

seconds. It was in the case of a little boy, aged nine, who had two teeth removed without feeling the least pain. It is very difficult to state the longest time that a patient has been thoroughly under the influence of this anæsthetic ; but with one administration as many as eight extractions have been performed without any consciousness on the part of the patient.

As a general rule, at the same sitting a patient gets more quickly under the action of the gas at the second administration than at the first, and sooner again at the third than the second. It is a most unusual circumstance to find a patient, who has previously been under the influence of chloroform, prefer it to the gas. In one case where the gas was given with complete success, the boy (aged fourteen) had about six months previously tried to take chloroform, but so much faintness was produced, that it was deemed advisable by the medical man to discontinue the chloroform, and put off the operation. A gentleman well skilled in the administration of bichloride of methylene attempted to give it in two cases, but both patients refused to continue the inhalation on account of the pungency of the vapour, though both took this gas easily and well. Another patient, in whom the effect of the nitrous oxide gas passed off in a few seconds, had on a previous occasion, when chloroform had been administered, suffered from nausea and vomiting for 48 hours.

The lividity and pallor which take place have been much objected to ; but to those accustomed to administer this gas, these symptoms (which, however, do not *always* occur) give no alarm. During the period of inhalation and unconsciousness it is not uncommon for various muscles to become spasmodically contracted. In a lad of seventeen the internal recti muscles of the eyes were contracted, and double internal strabismus took place. In a girl of ten, who did not appear nervous when placed in the chair, the bladder was the organ affected, and micturition took place as unconsciousness set in. Opisthotonos sometimes occurs, and in these cases if the back of the operating chair is smooth the patient may slide from under the dentist's hands. This does not take place where the back of the chair is covered with some rough material.

All the muscles of the body, and the limbs generally, may

be affected, and a species of epileptiform seizure may take place. This occurred rather severely in five cases at the Hospital as the patients were recovering after the operation. The spasmodic struggling lasted in these cases about eight seconds, and then passed off on the return of the patient to consciousness. All these five patients were healthy males; and none of them could recollect that they had ever been subject to fits of any kind. On the other hand, five patients who stated that they frequently had epileptic fits, and one patient who for some time had suffered from constant palpitation of the heart, took the gas, and recovered remarkably quietly and quickly. A gentleman who had for some hours previously been keeping up his courage with brandy, and was more than half intoxicated, took the gas well.

In one case the respiration became very shallow and rapid, as anæsthesia came on; whilst in another, during a second administration of the gas, it suddenly ceased. The tooth was at once extracted, and pressure made on the thorax, thus causing a forced expiration; and the pressure being suddenly removed, the lungs filled; the patient again commenced breathing, and recovered well. In two cases where there was tubercular consolidation of the apices of the lungs, recovery was not materially different, but rather slower than usual. In one patient, subject to spasmodic asthma, the gas was particularly successful. The arcus senilis was well marked in several cases, and in these the arteries were hard, tortuous, and loaded with atheromatous matter, yet these patients did well. Some patients were anæmic in the extreme, and it was noticed that the colour in the cheeks was better after than before the inhalation. Several were in a most debilitated condition—some from want of food, and some from neuralgia; all of these also did well. One of them was a man in the habit of smoking opium and tobacco mixed, and he stated that for months past he had smoked 4 ozs. of tobacco daily.

Faintness followed the recovery of the patient in two cases; one of these was supposed to arise from tight-lacing, to conceal pregnancy. Vomiting has followed in five cases. In two it was believed to be hysterical; in one it was due to blood lodging about the fauces, and causing an attack of

coughing and retching; and in another the patient felt very sick before coming into the room. Several hysterical women had slight fits of hysteria after taking the gas, but rapidly recovered under appropriate treatment. One of these commenced screaming as soon as she began to become unconscious, and she screamed incessantly until anæsthesia took place; the screaming was again repeated during her recovery. This patient had the gas three times, at an interval of a week between each administration, and behaved exactly the same each time. In cases where patients are not at all nervous, it has frequently been noticed that the pulse, which before the inhalation was small and weak, has gradually improved in character as the inhalation continued.

In six cases the patients became greatly excited, and struggled so violently that the operations were performed with very great difficulty; and in one or two of these cases the gas had to be given a second time, because the operator was unable to place the instrument on the tooth before recovery. If, when a patient is just becoming unconscious—that is, when he cannot hear, or is unable to raise his hand, if ordered to do, so—the eyelid is raised and the conjunctiva touched, a certain amount of return to consciousness takes place; and it is not thought advisable therefore that the sensitiveness of the eye should be tested until the patient seems pretty thoroughly insensible. The insensibility of the conjunctiva to the touch cannot alone always be relied on as being a certain sign of inability to feel pain.

It is perfectly clear that in some cases patients awake with the same idea in the mind that was present when they became unconscious; for patients who have raised their hand each time they have heard the seconds counted, before becoming insensible, have been noticed to begin beating time with the same hand as recovery took place. Another patient, who before inhaling apologized for his nervousness, continued his apologies as he recovered consciousness.

Mr. Harrison here said that, as Chairman of the Committee from which the Report had emanated, he should be happy to answer to the best of his power any question that might be

put to him in the course of the evening, and to take any part in the discussion which might follow its reading that might be expected from him ; but suggested that it would probably be to the advantage of the meeting that gentlemen having questions to put should ask them of the Committee in its collective capacity, rather than of himself individually ; as it must be obvious to all present that, in a mixed committee of gentlemen, selected to inquire into an abstruse subject of the kind under consideration, some would be better acquainted with certain parts of it than others were, and *vice versâ ;* and that, by following this suggestion, the meeting would be more likely at once to arrive at the information required, from the best possible source.

Discussion.

The President, after the list of visitors had been read, said they were honoured with the presence of many gentlemen of eminence in the medical profession, which, he need scarcely remark, was a source of pleasure to every member of the society ; and he trusted they would consider themselves quite at home, and, as members of the society for the evening, join freely in the discussion.

Mr. Norton regretted that the Committee had come to no conclusion with regard to the physiological effects of the nitrous oxide gas. It appeared to him that the inhalation of this gas, which possessed no irritating properties, was literally a process of deception practised upon the lungs, inasmuch as the lungs were capable of inflation, though at the same time no free oxygen was admitted. Nitrous oxide was in no way altered by respiration, and since it was not a solvent for carbonic acid, no carbonic acid could be eliminated from the blood. The first few respirations carried off carbonic acid ; but this Mr. Norton believed was due, not to any decomposition of nitrous oxide, but simply to the oxygen remaining in the lungs contained in the supplemental and residual air. All the symptoms exhibited during the respiration of nitrous oxide were those of apnœa.

Mr. Sewill had assisted Mr. Norton in his experiments on the lower animals, and in the administration of the gas to the human subject. He entirely agreed with Mr. Norton's opinion

as to the physiological effects of the gas. He had been so impressed that this was the only possible explanation, that he had quite expected that the Committee would have come to the same conclusion. Mr. Sewill pointed out that the administration of nitrous oxide would most assuredly be injurious in some diseases of the heart and lungs, and explained the *rationale* of this opinion.

Mr. Braine could not agree with the last speaker when he expressed his belief that the physiological effect was simply due to carbonization of the blood. He thought at one time that this was the case; but on trying the experiment just mentioned upon himself, instead of upon a rabbit, he found that in breathing expired air over and over again, though his lips became blue, and the sensation of want of breath was very distressing, yet he did not lose any control over his muscles. But it was very different when breathing the gas. If they would make a forced expiration, inhale some gas, and retain it in the lungs as long as they could, then expire it into an empty bag, and rebreathe the same three times, retaining the gas each time as long as they were able, they would, after the third inspiration, find themselves scarcely capable of putting the tip of one finger quickly on the end of another. Then, as regards carbonic acid not being expired during the anæsthesia of nitrous oxide, he might say that in several cases when patients had been in this condition, he had collected about thirty cubic inches of the expired gas, and had detected the presence of carbonic acid in every case. From these experiments he concluded that the anæsthesia was not due "simply to carbonization of the blood."

Dr. Sanderson said that, inasmuch as Mr. Norton had brought forward physiological views he could not agree with, he felt bound to advert to his own observations. He had only recently commenced his experiments, and they were consequently but comparatively few; but they had nevertheless been of an exact kind, and were directed to one end, namely, that of determining by the kymographion the variations of arterial pressure in animals under the influence of the gas. From his observations, which were about six in number, it came out perfectly clearly that, as regarded the action of nitrous oxide

on the circulation and respiration, there was no material difference between it and apnœa. The action of nitrogen as a neutral gas, compared with nitrous oxide gas, upon the respiratory movements, was nearly identical, and he had at first felt inclined to come to the conclusion that no difference existed between them. In man, as in animals, the action of the two gases was similar, so far as related to their effect on the heart and breathing. Both also produced anæsthesia. When nitrogen was used, this did not occur until the patient was already asphyxiated, *i. e.*, after three minutes or so of inhalation; whereas nitrous oxide rendered a patient insensible in less than a minute, *i. e.*, before the apnœal state had come on. In other words, nitrogen produced anæsthesia by means of apnœa; nitrous oxide independently of apnœa, by its direct action on the nervous system.

Dr. Marcet thought it unnecessary to tell them with what interest he had listened to the report of the Committee; and said he was pleased to think that the Committee had communicated the results of their first series of inquiries, bearing on the use of nitrous oxide gas, or protoxide of nitrogen, as an anæsthetic agent, considered practically, rather than wait to do so until the completion of their labours; and he trusted the subject would come before the public with all the weight which the Committee would certainly impart to it. He was under much obligation to Mr. Fox, who had enabled him to witness the administration of nitrous oxide in the Dental Hospital, and this agent appeared to him safer, and in other respects superior to chloroform for operations of short duration. Dr. Sanderson had shown that nitrous oxide did not produce insensibility by apnœa, or actual want of air, as occurred in suffocation, or from the respiration of innocuous gases containing no oxygen. Bearing this fact in view, and also considering that insensibility from nitrous oxide was invariably attended with a state of lividity of the face and lips, and that shortly after the inhalation of the gas had ceased, together with returning sensibility, the face and lips acquired a florid hue, brighter than normal, Dr. Marcet proposed the following theory as accounting for the phenomenon of anæsthesia under consideration. He believed that, when breathed, nitrous oxide entered the blood at the lungs, and was decomposed in the

circulation, yielding oxygen to form carbonic acid; but there was the following difference between the inhalation of nitrous oxide and of common air, and to this the anæsthesia was due—that oxygen as nitrous oxide found its way into the blood, according to Professor Graham's laws of diffusion, more rapidly and in larger quantity than oxygen breathed in air; and that consequently the amount of carbonic acid formed in the blood from the inhalation of nitrous oxide was greater than when common air was taken into the lungs. This excess of carbonic acid was the cause of the insensibility, and of the livid appearance of the face and lips. As soon as the inhalation of nitrous oxide was discontinued, the carbonic acid, present in blood in excess of its ordinary proportion, would diffuse itself very rapidly into the lungs, and become expired. The nitrous oxide in the blood which had not yet been decomposed, and was much richer in oxygen than common air, as it contained half its volume of oxygen, while common air only contained one-fifth, being less diffusible than carbonic acid, would remain behind; consequently its proportion in the blood relatively to that of the carbonic acid also in the blood, would become increased to such an extent that the blood would contain more oxygen relatively to its carbonic acid than it did when respiration was carried on with common air; hence the red colour of the lips and face, deeper than during ordinary breathing, occurring while the anæsthetic action of the gas was passing off. He had undertaken a few experiments with the hæmadynamometer, with the object of determining the degree of arterial pressure during insensibility from the inhalation of nitrous oxide, and had observed that, during the first stage of anæsthesia (usually considered as the safe period) the action of the heart was rather increased beyond its normal condition, or was certainly in no way lessened, while with chloroform it had been shown that the heart's action began to fail generally after insensibility commenced.

Mr. Gregory Smith said that in consequence of the interest he felt in the subject for discussion that evening, he had, previously to attending the meeting, endeavoured to acquaint himself with the subject, having for the purpose, amongst other works, obtained one written by Humphry Davy, afterwards

Sir Humphry Davy, in the year 1800. He (Sir Humphry Davy) not only treated the subject chemically, but actually experimented on animals and himself with nitrous oxide gas, and then analyzed the products of expiration. In experimenting on himself for the purpose of testing the nature and purity of the gas, he inhaled such a quantity of not only this but other gases, as to very nearly sacrifice his life. Very probably, on account of its being an old book, it might have escaped their observation, but he would advise the members of the Society to procure it, if possible, as they would find the subject of the "anæsthetic properties" of the gas fully set forth in respect to every point of interest which had been mentioned that evening. This he thought would take away all the merit which gentlemen might be disposed to claim for themselves as to the priority of discovery of its anæsthetic powers. With permission, he would read a single extract from the work he had referred to.* It was to the following effect :— "As nitrous oxide in its extensive operation appears capable of destroying physical pain, it may probably be used with advantage during surgical operations in which no great effusion of blood takes place."

Mr. COLEMAN said the meeting were discussing a question upon which the Committee had not ventured to offer an opinion. Theirs was a preliminary report only, and they had refrained from expressing any view upon the physiological action of nitrous oxide gas, believing that further carefully conducted experiments would enable them to decide this question ; and they hoped to deal with it in their final report. He felt much diffidence in offering an opinion opposed to such an authority upon physiological chemistry as that of Dr. Marcet, yet he would venture to do so, knowing that gentleman to be as great a lover of truth as he was an authority upon the subject they were discussing. He (Mr. Coleman) believed that nitrous oxide gas was not decomposed in the blood. Firstly, because it was a

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* "Researches, Chemical and Philosophical, chiefly concerning Nitrous Oxide, or Dephlogisticated Nitrous Air and its Respiration." By Humphry Davy.

very stable chemical compound; too stable, he believed, to be deoxidized by any of the components existing in the blood or animal tissues. Secondly, there was this fact; protoxide of nitrogen consisted of two volumes of nitrogen, and one of oxygen occupying the space of two volumes; and if it were decomposed in the blood, it ought when breathed backwards and forwards out of a small bag, to suffer no diminution in volume—*i.e.*, the nitrogen returned from the lungs would be equal in volume to the nitrous oxide inspired. This was not so; the bag was soon emptied; that is, absorbed into the blood. Thirdly, the blood of a person under the influence of nitrous oxide was of a dark venous colour, showing absence of oxygen. Fourthly, after breathing nitrous oxide gas, the quantity of carbonic acid given off from the lungs considerably diminished, whereas it should increase if the effects of the gas were due to hyper-oxygenization. And fifthly, because he had practically put his opinions to the test by administering the gas to patients, so as to allow them to breathe it over and over again, taking care to remove the carbonic acid given off at the lungs. This method, he felt convinced, had answered as well as when the gas was respired only once; but upon that point he was of course a prejudiced party, and he should prefer the opinion of the Committee, or a sub-Committee of the Committee, upon it to his own. He believed with regard to the action of nitrous oxide gas, as Dr. Snow did with regard to chloroform, that its anæsthetic effects were due to the absence of oxygen. Still, they could not be similar to the action of carbonic acid (which was administered some years ago as an anæsthetic at Vienna), as in that case the blood was charged with carbonic acid, and it was not given off from the blood; nor was its action precisely similar to that of nitrogen or hydrogen, which were hardly soluble in the blood, whereas nitrous oxide was very soluble. The subject they were now discussing was the one least touched upon in the report. In it many questions of a practical character were handled, and he trusted these would receive some share in the discussion.

Mr. Cattlin said he should not have risen so early in the discussion, but he thought experiments which he had made upon the lower animals would help to clear away some of the difficulties

of the subject and give a new feature to the discussion. He could not agree with those who thought the anæsthesia which was produced by nitrous oxide was due entirely to asphyxiating properties; and he believed that the meeting would admit that the following facts would justify the doubt he felt upon the subject. On one occasion an inhaler (after Snow's principle), made to fit a pig eight weeks old, was bandaged over the mouth and nose for the purpose of administering nitrous oxide. The nitrous oxide was contained in a large india-rubber bag like that used at the Dental Hospital, and it was connected with the inhaler by india-rubber tubing, which had a stopcock, and had also been tightly tied to prevent the escape of the gas. The pig became thoroughly unconscious and lay as if dead after the inhaler had been applied for about three minutes. Nevertheless, it showed *evident signs of feeling* whenever it was pricked with a spur. This fact had created some surprise, when it was discovered that the tube connected with the india-rubber bag had not been untied, and the animal could not possibly have inhaled any nitrous oxide, but had been asphyxiated by the inhaler and bandages. The same pig was allowed to run for some time in a paddock, and when in full strength the same inhaler was bandaged over the mouth and nose with the same bandages, and nitrous oxide was administered from an india-rubber bag. At the expiration of one minute the pig was quite unconscious, and did *not* manifest any sign of sensation when sharply pricked with a hunting-spur; in short, the animal was in a perfect state of anæsthesia. To test the correctness of the results derived from this experiment, two strong pigs (four months old) were procured fresh from a neighbouring farmer. One had the same inhaler tightly bandaged over the mouth and nose, so as to exclude air. At the end of three minutes it was quite unconscious, but *evidently felt every time it was punctured with a large needle.* The other pig inhaled nitrous oxide through the inhaler out of an india-rubber bag. Anæsthesia was produced in one minute, and at the end of one minute and twenty seconds the inhaler was removed. The pig was sharply punctured with a large needle, *but did not show any sign of sensation.* Mr. Saltzman, the House Surgeon of the Sussex County Hospital, and Mr. Dennant, who was now

present, kindly assisted him in these experiments. He would not venture to give an opinion upon the causes of anæsthesia and apnœa; but there was evidently a difference in their power of destroying sensation, which perhaps some of the eminent physiologists whom he saw present would explain. Another experiment was made in the presence of the gentlemen just named to test the mode of death by nitrous oxide. A three-parts grown tame rabbit was placed under a large propagating glass which had been filled with nitrous oxide lately obtained from Mr. Barth. It jumped about in the glass, and soon became unconscious. The respirations *gradually* became weaker and weaker, and *entirely* ceased in a minute and a half. It was allowed to remain in the gas five minutes, but no effort at inspiration was made. The pulsation of the heart could be felt for a short time after it had been removed. A strong wild rabbit was then placed in the same jar filled with fresh gas. It jumped about for a few seconds, became unconscious in about half a minute, and the respiration, which gradually became more and more feeble, ceased altogether in two minutes. It was removed from the nitrous oxide at the expiration of three minutes, and placed in a jar of Barth's oxygen gas; but as the animal did not breathe, the effect of the gas was nil. The heart of this rabbit also beat for some minutes after respiration had ceased. When the circulation had stopped the muscular substance of the heart was punctured, but it did not move. He mentioned these experiments, to show that the pulse cannot be relied on as a sign of safety when nitrous oxide is given. From personal experience he could confirm the statements and recommendations contained in the report. All who had given the nitrous oxide would often have met with similar cases to those tabulated, both of the favourable and unfavourable class. He would, therefore, only mention a few interesting cases, which had either occurred in his practice at Brighton, or which had come within his knowledge from a source upon which he could thoroughly rely. He would mention only such cases as the committee from their report did not seem to have met with. A young lady aged seventeen was placed under the influence of Barth's nitrous oxide through Mr. Clover's mouthpiece, for the purpose of undergoing a rather severe dental operation.

Mr. Humphrey of Brighton was present as her medical attendant. Anæthesia was produced in one minute, accompanied by the congested and deathly appearance of the countenance which is so often met with. Sensation returned very quickly, and the gas was again inhaled for one minute. Sensation again returned before the operation was completed; after which the patient remained in the operating-room for half-an-hour in a state of partial unconsciousness very like that produced by poisoning with opium. She was led to a carriage by two assistants, remained in a state of stupor during the journey, and when she arrived home strong tea or coffee was administered, and she was made to walk briskly about for a quarter of an hour. After the expiration of that time she recovered consciousness, and had not since had headache or any unpleasant symptom. A case in which faintness lasted the whole day had come within his knowledge, but it did not occur in his own practice; it was that of an anæmic lady who inhaled nitrous oxide for two minutes, and it was discontinued on account of faintness. It did not produce anæsthesia, and she complained of the pain of the operation. His son, who had successfully administered the nitrous oxide as an anæsthetic 134 times, had mentioned to him the case of a patient whom he kept in a state of unconsciousness for thirteen minutes, and in whom he produced anæsthesia, whenever he wished to operate, by administering again and again a fresh dose of the gas.

Mr. Clover then exhibited and explained his apparatus for administering the gas. For some time he made use of his chloroform apparatus, merely putting nitrous oxide into the bag instead of air and chloroform. The position of the bag at the back of the administrator, instead of being on the floor, and the short wide tube made with spiral wire inside, were more convenient than the apparatus introduced by Dr. Evans. But inasmuch as a small admixture of air with the gas prevents its proper action, he had modified the facepiece* of this apparatus so as both to economize the gas, and effectually to administer it free from air. This modification was especially useful when the

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* *Vide* illustration at page 69.

face of the patient was much covered with hair, or when the cheeks were thin and collapsed in forcible inspiration. He had observed that many patients respired so energetically that the gas could not be supplied fast enough; a vacuum was formed under the facepiece, and air was drawn in. He therefore connected with the facepiece a supplemental bag, holding about 200 inches, by means of a tube and stopcock $\frac{3}{4}$ inch in diameter. The patient should respire eight or ten times before this stopcock was opened, in order to get rid of the residual air from the chest, and replace it by nitrous oxide. The communication with the supplemental bag being now free, a portion of the expired gas was received into it at every expiration, the other portion escaping, as usual, through the expiratory valve. In the succeeding inspirations the gas would be partly supplied by the supplemental bag, and partly from the larger bag as at first, and so freely as to prevent air being drawn in through any small chink where the mask might have incompletely fitted the face. In giving the gas for dental operations, the means of keeping open the patient's mouth was a subject of practical importance. The ordinary wooden gag or prop was liable to slip if the patient opened his jaws after it had been applied; he had therefore improved it by having the central portion made like a telescope, and placing a spiral spring inside it, so that, however widely the mouth might be opened, the gag would elongate itself and remain in contact with the teeth.

Mr. Haynes Walton felt that they had derived a great deal of valuable information from the report and the discussion, but he would be glad to know if the Committee considered nitrous oxide possessed any considerable advantages over chloroform; and, likewise, how far it was applicable in more prolonged operations. He had heard the report, but the committee had not stated in it whether in any instance this gas had been administered for some minutes together uninterruptedly. He had employed it on several occasions, and the result of his experience was, that it was unsuitable in cases where it was necessary to keep the patient in a state of unconsciousness for any length of time. He had a great dread of death ensuing in prolonged administrations of it. He would be glad to have the opinion of the committee on

these points. He was frequently asked by his patients whether he would not use nitrous oxide in preference to chloroform, and he invariably answered them in the negative.

Mr. CLOVER had given the gas in several minor operations in surgery, and in one case the patient was kept perfectly insensible for five minutes; but he thought that whenever the operation must necessarily be prolonged, that chloroform was a more suitable agent for producing anæsthesia.

Mr. DENNANT rose to make one or two practical remarks which he hoped might be of service to those who were seeking information on this subject. In the course of his experiments, he had found that the effect of the gas differed in various cases, according to constitution and temperament. He had noticed also that the effect produced upon the same person might vary considerably upon different occasions. He would quote a case :— A female, aged 26, inhaled the nitrous oxide in the presence of three or four medical men, and he removed three teeth. She recovered consciousness in 115 seconds, and was quiet throughout this operation. A week following he removed two more teeth under the influence of the gas, and during the operation she gave a scream. On questioning her, on recovery, she stated that she did not scream in consequence of pain, but from a fright received whilst in the act, as she thought, of entering an omnibus. On a third occasion he removed three teeth, when she screamed violently twenty seconds after the application of the inhaler, and continued to do so until the end of the operation, which lasted 103 seconds. As before, she felt no pain, but she came to in a very excited condition, and he then ascertained that she was subject to hysterical attacks. A second case of interest was that of a lady about 26 years of age, five months advanced in pregnancy, who went to him a week ago for the removal of an upper and lower molar and a buried wisdom stump. She recovered in 110 seconds, without any untoward symptoms, and is now in the most perfect health. He could also confirm Mr. Cattlin's remarks relating to his experiments upon pigs. The difference between anæsthesia in the one case, and asphyxia in the other, was very marked.

Mr. WALKER called the attention of the President to the

number of administrations of the nitrous oxide gas to children under 10 years of age, as tabulated in the report. He had been very successful in operating on children from the age of 5, and upwards. When children understood what was required, viz., gentle but regular breathing, they inhaled the gas most satisfactorily, the inhalation and the operation occupying only one minute. For protracted operations, such as extracting a lower wisdom tooth when embedded in the inferior maxilla, he should prefer the administration of chloroform. One case of this character occurred in his practice, when Mr. Clover was administering the gas. At each attempt to remove the tooth the patient recovered consciousness before he could accomplish the operation.

Mr. C. J. Fox, in answer to Mr. Walton's question, said he had administered the gas for twenty minutes, in a case of removal of the breast, by Mr. Carr Jackson. He was not ready to assert that the gas as at present used was the most suitable anæsthetic for prolonged operations, but he thought it possible it might become so.

Mr. Coleman said he had also administered it in several instances where short surgical operations, varying from one to six minutes, were performed ; and thought there was a probability of being able to carry it on twice the latter length of time ; but he had arrived at the same conclusion as other gentlemen, namely, that it was not suitable for long operations.

Mr. Rendall remarked that it was with some diffidence he rose, as he had administered the gas in only sixteen cases. He might state that in the majority of cases he gave it to the patient until fully under its influence. Then, permitting him to recover partially, that is, to recover his colour, he renewed the supply ; and in this condition, although the patient might occasionally flinch, he could feel no pain. But in one case he was desired to keep on the gas, and he did so for six minutes. It was given in the method mentioned by Mr. Coleman. The patient was a woman about fifty years of age, and by the time the gas was turned off she was really in a very alarming state. She was placed upon her left side. The pulse fell rapidly, and the respiration became more than usually alarming. She,

however, recovered in a short time, but he would not like to try the same experiment upon another person.

Dr. KIDD agreed with Mr. Coleman as to the *modus operandi*. He had noticed the presence of vomiting. If they could ensure against that, it would be valuable in surgery, but vomiting after an operation was often very dangerous.

Mr. WEEDEN COOKE also stated that he had administered the gas for a period of five minutes in some operations, and had even removed the breast. It had not acted injuriously on any patient under his care, but he would nevertheless not like to exceed five minutes.

Mr. KEMPTON stated that, in administering the gas to a girl eleven years of age that morning, it produced considerable vomiting, and after recovery she fell into a sort of stupor, from which they only succeeded in arousing her by walking her about the room for twenty minutes.

In reply to a question of Mr. PERKINS,

Mr. CATTLIN said he had rarely observed any symptoms of sickness. The patient referred to as having symptoms resembling poisoning by opium did not recover consciousness during the progress of the operation. She remained in a semi-unconscious state, and continued in that condition half an hour or thereabouts. Ammonia and other restoratives were applied without much effect.

In reply to a question as to whether the gas deteriorated in quality by being kept in store,

Mr. CATTLIN said he had experimented lately with gas from one of the first bottles sent out by Mr. Barth. It had been kept carefully for five months in a moderate temperature; but in every case it failed to produce anæsthesia until the animal had been under its influence about five minutes.

Mr. FOX stated that he had had two of Mr. Barth's bottles in his house upwards of ten weeks, and upon using them a day or two previously he found the gas as good as any he had ever used.

Mr. DENNANT had also witnessed Mr. Cattlin's experiments upon animals with nitrous oxide which had been made five months ago by Mr. Barth, and gas which was about a week old; and the difference between the effect of

the two samples of gas upon the various animals was very great. He made these remarks, because he thought it a question calling for close attention. One experiment he would allude to upon two guinea-pigs, which were placed in the two samples of gas under glass receivers: the animal which was exposed to the *old gas* for one minute knelt for a few moments in an apparently insensible state, but it entirely recovered in thirty seconds. The other guinea-pig, of the same size, which under similar circumstances was made to inhale the *new gas*, became profoundly anæsthetic in less than one minute; and took three minutes in recovering. In consequence of these and subsequently repeated experiments, he, Mr. Dennant, confirmed Mr. Cattlin's opinion that the old gas made by Mr. Barth five months ago failed in all the experiments, while that lately supplied by him was perfectly successful. That was a candid statement of facts.

The PRESIDENT said the report which had been read, and the discussion which had taken place upon it that evening, could not, he thought, fail to have interested every gentleman present; nor could he believe that any doubt would exist in the minds of any that a very valuable anæsthetic agent had been added to those already in use for relieving the sufferings of the afflicted. Those present, he thought, could not fail also to perceive and appreciate the various modifications and improvements that had been added by Mr. Clover and others to the apparatus used in its administration since its first introduction into this country; and by Mr. Coleman, in his ingenious arrangement for economizing the consumption of the gas in public practice. Again, the bottles of Mr. Barth, containing the gas in a compressed state, were of much value in greatly diminishing the inconvenience experienced in its transmission. He had no doubt that when the Committee felt justified in making a further report they would be able to announce other ingenious and scientific arrangements. He hoped also that they would then have some important physiological knowledge to impart. To the Committee generally he begged to offer the thanks of the Society for the valuable report they had furnished; but he felt he should be neglecting his duty were he not to bring more prominently before them the names of certain

members of the Committee. To Mr. Harrison (the Chairman), to Mr. Clover, Mr. Coleman, Mr. Gale, Mr. Underwood (the Hon. Secretary of the Committee), and to Mr. Braine, they were principally indebted for the report, and to those gentlemen specially he begged to offer the warmest thanks of the Society.

The Meeting was then adjourned to the 11th of January next.

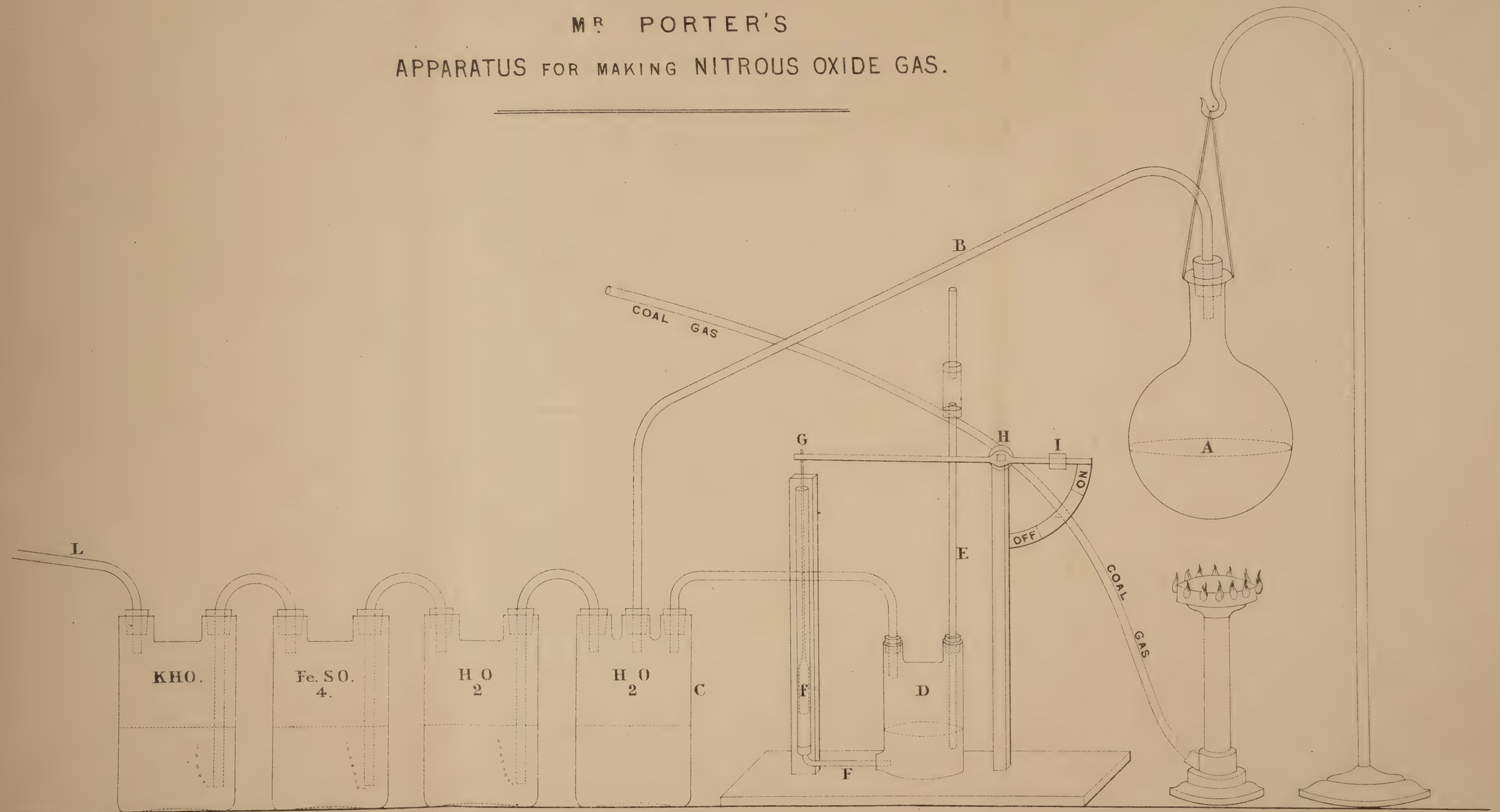
DESCRIPTION OF DIAGRAM OF MR. PORTER'S APPARATUS FOR MAKING NITROUS OXIDE GAS.

The principle of this apparatus is based upon the fact that pressure exerted upon a column of water supports the same at various heights in proportion to its force; and the idea is brought into action by having a float in this column attached to a lever which has for its fulcrum the plug of the gas tap that supplies the heat. The apparatus given in the diagram consists of a flask (A) of 60 oz. capacity, provided with a perforated cork and a tube (B) of suitable length and diameter. This is fixed in the centre neck of a three-necked Woulffe's bottle (C); one exit is in connection with three wash bottles, containing respectively—water, sol. sulphate iron, and liquid potash, and the other neck contains a tube that leads to the Thermal moderator, the gas passing out at L into the receiver. The Thermal moderator is a bottle (D) with three perforations —two at the top, and one near the bottom. One of the perforations in the top contains a tube, through which passes the pressure from the first Woulffe's bottle (C) and flask (A); and the other top perforation has a perpendicular tube (E) fitted up with a whistle at least six inches above the column of the water under the greatest pressure, the other end passing midway into the water. The third perforation, near the base of the bottle, is provided with a tube (F) that is sufficiently widened a little above the ordinary level of the water to carry a float, *f*. The float is attached by means of a cord to the end of a lever (G, H). This lever has for its fulcrum (H) the plug of the gas tap that supplies the heat to the flask, and at the other end of the lever a counterpoise (I), so that when the weight of the float is supported by the water instead of the arm of the lever, the counterpoise will pull down that end, and so alter the position of the tap H, or, in other words, turn off the supply of heat. So that if the gas is liberated too quickly because of the excess of heat, it exerts a pressure, raising the

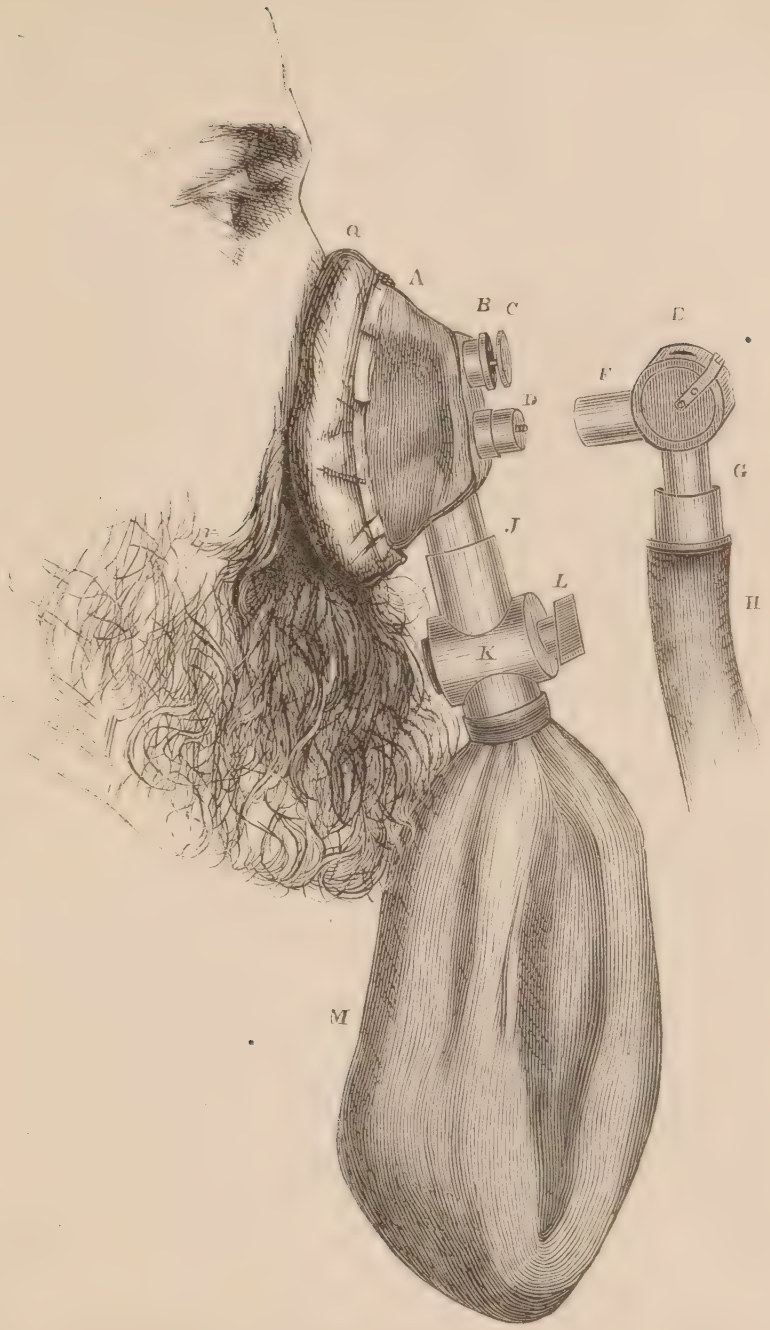
column and turning off the heat, when the evolution of the gas and pressure will diminish, and the heat be turned on again. And thus it moves up and down until it attains a position where the pressure and heat are balanced, and there it will remain four or six hours, or as long as the nitrate of ammonia lasts. The arm of the lever is prevented from quite extinguishing the gas by a stop, so that when the pressure diminishes the gas may re-kindle, which unfortunately is not the case with Sprague's apparatus. If by any means the exit of the gas is closed (as the doubling of the india-rubber tube, the bag being full) or should the gas be generated too fast, from the lamp being too close, or any such cause that would increase the pressure, then the column of water would gradually rise, at first turning the tap off to its stop, and then force so much water into the pressure tube as to diminish the height of the water in the bottle below the orifice of the tube E, when the gas rushes up, sounding the whistle on the top, to give an alarm that something is amiss. This apparatus, although it may be considered as an addition to the ordinary arrangement, does indeed perform the most important function of them all, inasmuch as it prevents so many disastrous effects that result from the supply of heat not being properly regulated, such as the production of higher compounds of nitrogen, and as nitric oxide, nitrous anhydride, and even nitric peroxide, together with free nitrogen from excess of heat, and often the bubbling over of the fused nitrate, that somtimes solidifies in the tube of the flask, causing the latter to burst, which is often attended with serious injury to the operator, as it may contain 3 or 4 lbs. of fusing nitrate of ammonia at a temperature near to 400° Fahr. It also has great advantages over others as there is no need for disconnecting the tube of the flask, because any vacuum formed in the latter is supplied with air drawn through the whistle into the 3-necked Woulffe's bottle flask. And beside these, it saves much trouble of moving the gas and watching the whole time it is being made, and also ensures the purity of the gas (*i.e.*, if the nitrate ammonia be pure). With an apparatus of this kind and 4 lbs. of nitrate of ammonia 100 gals. of gas has been produced, without any attention more than starting and turning out the gas at the end, in 4 hours.

MR PORTER'S

APPARATUS FOR MAKING NITROUS OXIDE GAS.



Wyman & Sons, Great Queen Street, London.



MR. CLOVER'S FACEPIECE, &c., FOR THE DIRECT ADMINISTRATION OF COMPRESSED NITROUS OXIDE GAS.

A, the flexible metal oro-nasal mouthpiece.

a, a border of soft indiarubber tubing.

B, the expiratory valve.

C, a protective brass cap.

D, the inspiratory valve, which is attached to the supply-pipe H at F.

E, an opening for the supply of air when the gas is turned off. When the handle is moved to E the gas is turned on, and the air excluded. When the handle is moved to G the gas is cut off, and atmospheric air is admitted.

J, point of attachment of supplemental bag M. K L, stop-cock, by which the bag is opened and closed.

ANNUAL GENERAL MEETING,

Monday, January 11, 1869.

JAMES PARKINSON, Esq., President, in the Chair.

The Minutes of the last Meeting, having been read, were confirmed.

The following gentleman was duly elected a member of the Society :—

Mr. Francis John Vanderpant, of Clifton Lodge, Kingston-on-Thames.

The following gentlemen were proposed for election :—

Mr. J. Dennant, Western Cottage, Brighton.

Mr. Arthur Baxter Visick, Ravensdowne, Berwick-on-Tweed.

It being the occasion of the annual election of officers, scrutineers had to be appointed. According to custom six names were proposed, and two were selected from these. The two returned were Messrs. Petty and Turner. The ballot-box then remained open for an hour for the depositing of voting papers.

Mr. Charles James Fox said he had long endeavoured to persuade those who supplied the compressed nitrous oxide to put it up in larger quantities, and in comparatively lighter vessels. He had given much time and attention to the subject, and had at last, with the aid of Mr. Coxeter, of Grafton-street, Tottenham Court-road, succeeded in obtaining the apparatus which he now exhibited. He produced two iron vessels, one about 28 inches long, and $4\frac{1}{2}$ inches in diameter, the smaller one weighing about 20 lbs., not much more than one of the ordinary 15 gallon iron bottles, but holding 6 cubic feet, or

36 gallons of nitrous oxide. It was enclosed in a close-fitting box, which stood firmly on end, and was provided with lock and key, and a handle at the side, so that it could be carried like a portmanteau. The other bottle, measuring 28 inches in length, and $6\frac{1}{4}$ inches in diameter, contained 12 cubic feet of gas, and stood upon a light iron tripod. The bottles were furnished with a tap, of most accurate fit, so that escape of gas was impossible, and its issue was under perfect control. With regard to the gas in these bottles he would only say that he had found it most excellent, and had used it with perfect success. Mr. Fox also exhibited a Clover's face-piece, made for him by Mr. Coxeter, so much improved in shape, as to be generally a good fit to the face. The apparent difference from others was very slight; but the real difference was very evident upon using it. That morning, at the Dental Hospital, he had anæsthetised seven or eight patients, in from 40 to 60 seconds each, and in private practice his cases had been equally rapid since his adoption of the improved face-piece. One lady, that morning, had been thoroughly anæsthetised in 30 seconds; he could not but feel that this was due to the improvement in the shape and fit of the face-piece, by which the inspiratory valve was brought close to the mouth. Another inhaler he had had made, he would only allude to briefly, as it was of no practical value to them as Dentists, but would be useful to those who desired to pursue experiments with reference to prolonging the anæsthetic effects of the gas for use in general surgery. He (Mr. Fox) believed that if a patient was once thrown into a deep sleep with pure, undiluted gas, the anæsthesia might be maintained by the administration of certain proportions of gas and air or other chemical agents. Although he had been successful in his experiments on this subject so far, yet much more must be accomplished before he could say this was more than a mere theory. The instrument made for him by Mr. Coxeter was so constructed that the administration of air could be regulated.

The following Donations were made to the Library and Museum :—

Mr. Edward Hulme, of Gower-street, presented a very fine specimen of the rostrum of the saw-fish (*Pristis antiquorum*).

Mr. R. H. Collyer,—"History of the Anæsthetic Discovery."

Mr. R. H. Collyer, — Fossil Human Jaw, found in Coprolite Pit, Suffolk.

Mr. Bartlett, — 2 vols. Rowley's "Scholæ Medicinæ," 2 vols. Murray's "Chemistry," 1 vol. Clarke, On Management of Teeth, 1 vol. South, On the Bones.

Mr. Hulme (Curator), read the following Paper on the Formation and Arrangement of a Dental Museum.

On the Formation and Arrangement of a Dental Museum, with a proposed Dental Classification of the Placental Mammalia. By Robert T. Hulme, M.R.C.S.

Mr. President and Gentlemen—

In forming a Museum intended to illustrate any special branch of Natural History, it is necessary in the first place to determine the scope and limits of the subject. While this should be done in a wide and comprehensive spirit, so as to exhibit the relation in which the special department stands to the general science of which it is a portion, it ought, at the same time to be so far restricted as to retain the distinctive character of the collection.

The comparative anatomist classes the teeth with the skeleton, while the physiologist regards them as forming a portion of the digestive organs. The function of digestion consists of a mechanical and a chemical action; the first is accomplished in the higher animals by means of the teeth, the second by means of the stomach and various glands, some of which prepare the food for its entrance into the stomach, while others exert their influence upon it after it has emerged from the digestive cavity. To include the whole of

the digestive organs and their various modifications throughout the animal kingdom in the collection would be to convert it into a physiological museum, and would extend it beyond what can properly be termed a dental museum. The specimens should therefore be confined to illustrating the history and modifications of those organs that are concerned in performing the mechanical portion of the digestive function. Another point, of not less importance, is to consider the requirements of those who may desire to avail themselves of the information to be obtained from the contents of the museum.

A dental museum intended for the use of dental practitioners must necessarily contain such a series of preparations as shall fully illustrate the anatomy, physiology, and pathology of the human teeth, and also of the parts with which the teeth are so immediately connected that disease in the one may extend to or influence the other. To these must be added specimens of the instruments and mechanical appliances employed in dental practice.

It might be considered that here the museum should terminate, but since man, although placed at the head of the animal kingdom, represents only one form of animal life, the knowledge which could be acquired of the physiology of the teeth would be extremely limited unless the varieties of dental development presented by other

animals were also included in the collection. When to this is added the importance of the teeth in the study of zoology; the use which may be made of them for the purpose of classification often enabling the naturalist to determine not only the family but even the species to which the individual belonged; the light they throw upon the food, habits, and organization of an animal; the information they give as to the nature of those extinct forms of life which inhabited our globe in former ages, and of which they are frequently the only records that are left; the propriety of including the teeth of the lower animals in a dental museum can hardly be questioned.

Incapable of being properly illustrated by preparations of the human teeth alone and liable to be lost sight of amidst the details of their comparative anatomy, the physiology of the teeth, or the general laws which regulate their development, growth, and structure should be illustrated by a separate series of preparations. In a purely scientific point of view, this series should, in fact, be placed at the head of the collection, but considering the special object and character of the museum, it is better it should follow the department connected with practical dentistry and precede the comparative anatomy series.

The microscopic structure of the teeth and the changes their tissues undergo in disease must

necessarily be included in the natural history and pathology of the human teeth; the ultimate structure of the teeth of the lower animals should also be shown in the comparative anatomy series. Inasmuch, however, as these specimens are of a distinct kind and require to be prepared and preserved in a different manner to those which illustrate the formal or external anatomy of the teeth, it will be most convenient to bring them together into a distinct series of microscopic preparations.

Should circumstances permit, a department might be advantageously devoted to the teeth of the animals indigenous to Great Britain, showing the changes which take place from the eruption of the temporary to the completion of the permanent set. In the case of the Horse, the Ox, and the Sheep whose commercial value depends upon their age, the order in which the teeth are lost as old age advances should also be shown.

It must be borne in mind that the whole of the class Aves and the Chelonian division of the class Reptilia are edentulous and are provided with horny mandibles of various forms adapted to the nature of the food and mode of life of the individual. These modifications of the jaws are not less interesting and instructive illustrations of teleological adaptations than those which are exhibited by the teeth themselves. Although it may not be necessary that every modification of the

beak should be represented, yet it is desirable that type specimens and such special modifications as are directly connected with the habits of the animal or the nature of its food should find a place in the collection.

Thus far the museum would illustrate the teeth of the vertebrate animals. If it is desired to complete the subject and to give the entire history of the cibarial instruments throughout the animal kingdom and of all that relates to the mechanical portion of the digestive function, it will be necessary to add illustrations of the modifications which the mouth undergoes in those lower forms of life which are collectively spoken of as the Invertebrata. Carried out in this manner the museum would consist of the eight following departments :—

1. Anatomy, physiology, and pathology of the human teeth.
2. Surgical instruments.
3. Mechanical appliances.
4. Physiology of the teeth.
5. Comparative anatomy of the teeth.
6. Microscopic structure of the teeth.
7. Teeth of animals indigenous to Great Britain.
8. Instruments employed by the Invertebrata in procuring and comminuting the food.

Having determined the scope and limits of the museum, the next object must be to ascertain the

best method of arranging the specimens. The two last divisions being only suggested as additions to be made to the museum at some future time, they need not detain us on the present occasion, while the manner in which the specimens belonging to the four first divisions should be arranged, is so far evident that it is unnecessary to enter into details as to the precise order of their distribution. With regard to the microscopic specimens, these will follow in the same order as the comparative anatomy series, and it is therefore the arrangement of the specimens belonging to this important division of the museum that has to be considered. The question is whether the same order and arrangement must be followed as the naturalist has adopted from the study of the other organs, or whether the teeth can be taken as the basis of a classification, without violating the natural affinities of the different families and orders belonging to the vertebrate sub-kingdom, and more especially of those which constitute the class Mammalia.

In a general anatomical museum, each system of organs belonging to the animal economy finds its appropriate place, and is illustrated by a separate series of specimens. Each series is supplemental to the others, and all of them together form one continuous and harmonious whole. By studying the different series, we may obtain a complete history of the organization of each in-

dividual animal, are enabled to determine its true position in the animal kingdom, and to form a correct estimate of the relation in which it stands to other animals. This cannot be accomplished in an unexceptionable manner by means of any single organ, even where it is of such importance as the nervous system, still less can it be done when we have only a comparatively subordinate system, such as that of the teeth. At the same time the teeth are so important amongst the higher animals, and afford such valuable information as to the nature of the food and the habits of the individual, that it is necessary to examine the subject somewhat in detail, and ascertain what use the naturalist and classifier have made of these organs, in their attempts to define and group together the different families and genera of the vertebrate animals.

In an ascending survey of the animal kingdom true teeth* are first met with in the class of fishes. In the majority of these animals the teeth are numerous; the cone, or some modification of it, is their usual form; they may be triangular, with smooth or serrated edges, or broad, flat, and adapted for crushing. Hence Agassiz has divided the teeth of the fish into *prehensile*

* A tooth may be defined as a peculiar osseous body situated in the mouth or at the commencement of the alimentary canal, serving to procure and masticate the food.

teeth and into *molar* teeth. Whatever form they may assume, they generally resemble each other in the individual, presenting a good illustration of what has been termed "vegetative or irrelative repetition." As we ascend in the scale of organization, that subdivision and specialization of the organs take place by which the various functions are brought to their most perfect condition. Thus the pectoral and abdominal fins of the fish, with their multiplicity of rays, are, in reality, the prototypes of the anterior and posterior limbs of the higher animals; and so also the hundreds of teeth with which the mouth of the Sharks, the Rays, the Osteoglossum, and many other fishes is beset, are the forerunners of the dental system of the Primates.

In most fish, then, the teeth closely resemble each other, and exhibit little difference in either their form or their function, excepting that those at the anterior part of the mouth may be adapted to seizing and holding the prey, while those at the posterior part may serve to lacerate and crush it, as exemplified in the tesselated jaws of the Cestracion Philippi, or Port Jackson Shark. Any increase in the number of the teeth simply adds to the power the creature possesses of thus holding and destroying its prey, the uses to which these organs are restricted in the present class, where the food is rapidly swallowed without undergoing any elaborate process of mastication. So long as

this repetition of a part continues, however well the organ may be adapted to the requirements and habits of life of the animal, it can afford no sound basis of classification. Hence the only use which the naturalist has made of the teeth in the classification and arrangement of existing fishes has been to designate some two or three families from certain peculiarities in their teeth. Thus we have the family of the Gymnodonts,* or naked teeth, and these are subdivided into the Diodonts † and Tetradonts,‡ or those with two and those with four teeth. In the family of the Goniodonts § the teeth are long, slender, and bent at an angle, from whence the name is derived. In the Chætodonts ‖ the teeth in their length and tenuity resemble hairs, and are collected in several close-set rows like the bristles of a brush. But while these families have received their names from the characters presented by the teeth, they have been classified by means of peculiarities presented by other parts of their organization.

On the other hand, when defining the minor groups into which the primary divisions of the class are subdivided, the teeth even in the fish often afford useful and readily-ascertained cha-

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* Gr. *gumnos*, naked; *odous*, a tooth.

† Gr. *dis*, two; *odous*.

‡ Gr. *tetra*, four; *odous*.

§ Gr. *gonia*, an angle; *odous*.

‖ Gr. *chaite*, a hair; *odous*.

racters by which the different genera may be distinguished from each other, or by which individuals belonging to the same family may be brought together.

Müller has employed the teeth, together with the arrangement of the breathing organs, and the number and position of the fins, to define the subdivisions, families, and genera under which he has arranged the various members of the Squalidæ or Sharks. But, the very fact that individuals belonging to different groups may yet possess the same dental characters is of itself sufficient to show the secondary importance of these organs in these lowest members of the Vertebrata as a means of classification.

With regard to the fossil species of fish which have been found in the different strata of the earth, many of them having belonged to the cartilaginous fishes, their remains have entirely perished, with the exception of the teeth; the consequence is that they have been named from some peculiarity in their position, their structure, or their form. Thus the term Acrodus * has been applied to certain cartilaginous fishes known only by their teeth, which are met with in the strata ranging from the Triassic system to the Upper Chalk. These teeth are supposed to have been aggregated about the extremities of the

* Gr. *Akros*, summit or extremity; *odous*.

jaws, in the same manner as those of the existing Cestracionts of the Australian seas. Dendrodus,* or tree-tooth, is the name that has been given to some fossil teeth from the Old Red Sandstone, and has reference to the dendritic appearance presented by their microscopic structure. The Pycnodonts,† or thick-toothed, constitute an extensive group of ganoid fishes occurring in the mesozoic strata. The mouth was furnished with a dense pavement of thick, round, or flat teeth, for the purpose of crushing the shells of the mollusks and crustacea upon which they fed. Sphærodus,‡ in which the teeth were circular, and arranged in regular rows, may be taken as an example of this group.

If the teeth of the fish cannot be relied upon for the purpose of classification, yet they often indicate the nature of the food, and to a great extent the mode of life, of the individual. When, therefore, we meet with fossil teeth bearing a close resemblance to those of certain existing species, it is only a legitimate and reasonable inference to suppose that they bore the same relation and proportion to the body of the former inhabitants of our globe that they do in the existing species, and that the habits and mode of

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* Gr. *dendron*, a tree ; *odous*.

† Gr. *pyknos*, thick ; *odous*.

‡ Gr. *sphaira*, a sphere ; *odous*.

life of the extinct animal resembled that of its living representative. The following instance may serve as an example of this kind of inferential knowledge, and shows to what extent the presence of a fossil tooth may open to our contemplation the history of the past :—

The Great White Shark, *Carcharias vulgaris*, one of the most powerful and formidable of its class, attains a length of from twenty-five to thirty feet; the mouth is armed with a series of triangular flat teeth, with cutting or finely-serrated edges. In the United Service Museum there was preserved a jaw of this species of shark, now in the collection of the College of Surgeons, the upper one of which measured four feet, and the lower one three feet eight inches following the curvature. The largest of the teeth measured two inches in length, and one inch nine lines in breadth; the entire length of the animal was thirty-seven feet. Fossil teeth have been found in the Tertiary strata of both the Old and New Worlds exactly resembling those of the existing Carcharias, but measuring six inches in length, and five inches across the base. These fossils, therefore, reveal to us the presence of an animal in those ancient oceans which probably exceeded one hundred feet in length, and possessed the formidable powers and voracity of the shark.

The remarks that have been made upon the teeth of the fish in regard to classification will also apply, although in a somewhat diminished degree, to the class Reptilia. The teeth are now confined to the cavity of the mouth, that is, there are no throat teeth ; they are attached to a smaller number of bones, and are reduced in number. The cone, or some modification of it, is still the prevailing form.

The following table of the Reptilia is introduced for the convenience of reference, and not as a complete classification of the class, only those orders and families being introduced which are referred to in the paper, and which are distinguished by some peculiarity in the dental system. Those printed in italics are fossil.

CLASS REPTILIA.

- Batrachia . *Labyrinthodont.*
- Ophidia . . { Non-poisonous. / Poisonous.
- Sauria . . . {
  - Scincidæ . . . . . Cyclodus.
  - Iguanidæ . . . . . { Pleurodonts. / Acrodonts.
  - *Iguanodon.*
  - Lacertidæ . . . . { Pleodonts. / Cœlodonts.
- Pterosauria. *Pterodactylus.*
- Crocodilia . { Crocodilidæ. / Alligatoridæ. / Gavialidæ.

Most reptiles are carnivorous, feeding upon a living prey, or upon the decomposing remains of

animal life that are carried down by the tropical rivers, on whose margins the larger species, such as the Crocodiles and Gavials, reside. Many of the smaller lizards are insectivorous, while some are herbivorous, feeding upon the tender and succulent parts of the plant, such as the leaf, the flower, and the fruit. In the carnivorous and insectivorous species the teeth perform the same functions as in the fish, and serve to seize, hold, and lacerate the prey; but in the vegetable-feeding Iguanians the conical teeth of the maxillary bones are expanded at the apex, assume somewhat of a trilobate form, and are notched at the edges, conditions which render them better adapted to crush and masticate the vegetable food upon which these animals live.

In the Batrachia the teeth vary so much in the different species that they cannot be employed as a means of classification; and this division of the Reptilia might have been passed over without any further remarks, had it not been for the discovery of certain fossil teeth belonging to gigantic animals whose nearest alliance amongst existing animals is with the Batrachia.* This, however, is not the reason for referring to them on the present occasion, but because the history of these

* This is the case, at least, in regard to some of the bones of the head and the distribution of the teeth. It is, no doubt, more correct to arrange them as a distinct order of the class Reptilia.

teeth shows in a remarkable manner the value of the microscopic characters as a means of identifying fossil teeth which may be met with in widely-separated localities, and also the important bearing which fossil teeth may have in determining certain geological questions.

In the Keuper division of the Triassic system, in Germany, some teeth, together with portions of the skull of an unknown reptile were found by Professor Jäger. A question had arisen as to whether the light-coloured sandstone of Warwick was the equivalent of the Keuper, that is the upper, or of the Bunter, that is the lower, of the three groups into which the Triassic system of Germany is divided. In the Warwickshire sandstone only a few teeth, or rather fragments of teeth and a portion of a vertebra had been found, these fragments constituting the only evidence the geologist possessed to guide him in his investigations.

The outward appearance of the fossils bore too close a resemblance to the ordinary type of reptilian teeth even to determine the question of relationship, much less of identity. It was under these circumstances that Professor Owen proceded to make sections of the teeth supplied him by Professor Jäger. Upon examining a transverse section, the most remarkable and complicated arrangement of the pulp, dentine, and cementum of the tooth was presented to his

view, which had hitherto rewarded his extensive and elaborate investigation of the dental tissues, whether amongst living or extinct animals. The complexity referred to arises from the pulp of the tooth sending off processes which again subdivide or branch off; around each of these pulp processes or branchings there is formed a layer of dentine, which is in like manner invested by a layer of cementum; the consequence is that long undulating tracts of dentine are seen with an external coating of cementum, bending in from the circumference towards the central portion of the tooth, suggesting to Professor Owen the name of Labyrinthodont* as descriptive of this peculiar maze-like or labyrinthic interblending of the tooth pulp and of the dental tissues.

On making sections of the Warwickshire teeth, they exhibited the same subdivision of the tooth pulp, and the same complex arrangement of the dentine and the cement, leaving no doubt of the identity of their possessors, and equally determining the geological question as to the correspondence of the Warwickshire sandstone to the Keuper division of the German Triassic system.

The Ophidian reptiles, for our present purpose, may be divided into the poisonous and non-poisonous. The former are at once distinguished

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* Gr. *labyrinthos*, a place full of intricate passages; *odous*, a tooth.

by the presence on the anterior extremity of the maxillary bone of a hollow conical tooth, commonly called the poison fang, through which the venom is conveyed into the wound. This peculiar form of tooth is produced by the bending of the pulp into a circle or ring, around which the dentine is arranged so as to leave a tubular passage passing from the base to the terminal point of the tooth, where it opens immediately beneath the apex. The only teeth which could be mistaken for a poison fang are the posterior maxillary teeth of some of the non-poisonous snakes (*Dryophis*, *Dipsus*, and *Bucephalus*), which are traversed along their anterior convex side by a longitudinal groove. This groove may possibly convey an irritating secretion into the wound which the animal inflicts, but has no connection with any poison-secreting gland, as is the case with the hollow fang of the true poison snakes.

But, while the presence of a poison fang clearly indicates the habits of life of the individual, its absence, being merely a negative character, is of no essential value to the classifier, and no use has been made of the dental characters in this division of the Reptilia, excepting as one amongst several other peculiarities, which, when taken together, serve to distinguish the different families from each other.

In the upper jaw of the Ophidia teeth are present on the pre-maxillaries, the maxillaries, and

the pterygoid bones, in the Pythons, Boas (fig. 1), and other non-poisonous serpents, so that upon

Fig. 1.

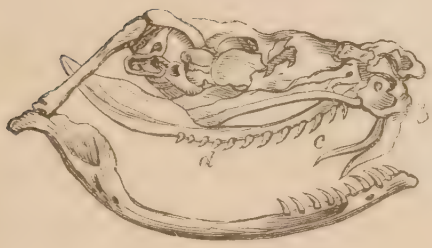
Half of the base of the Tiger-boa (*Python tigris*) : *a*, intermaxillary bone ; *b*, maxillary ; *c*, palatine ; *d*, pterygoid.

looking into the mouth there is seen four rows of sharp pointed recurved teeth, passing from the anterior to the posterior part of the palate. The two outermost rows correspond to the margins of the upper jaw, the two central ones to a line midway between the margin of the jaw and the central line of the palate.

In the typical poisonous snakes, such as the Crotalus (fig. 2) and others, the pre-maxillary bones being edentulous, and the maxillary bones having only the solitary poison-fang attached to

its anterior extremity, the rows of teeth are reduced to two in number, and this has been suggested as a means of distinguishing between the poisonous and the non-poisonous snakes. This distinction is invalidated by the fact that

Fig. 2.



Skull and teeth of a Rattlesnake (*Crotalus horridus*): *b*, maxillary bone and poison-fang; *c*, pterygoid teeth.

Fig. 3.

Dissected head of *Hydrophis striatus*: *b*, maxillary teeth.

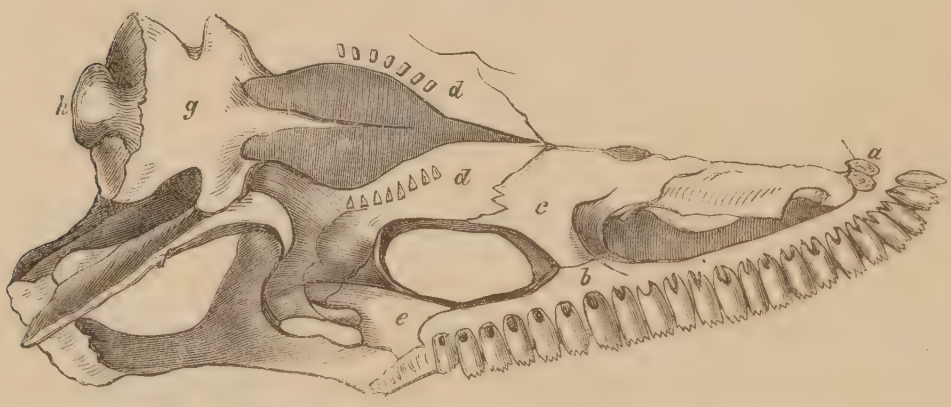
in the Hydrophis (fig. 3), a family of marine snakes, the poison-fang (*b*) is followed by four or five teeth attached to the maxillary bone, and therefore reproducing the four rows of teeth that are seen in the non-poisonous boas and pythons. So also in the Colubriform poisonous serpents of the land, behind the venom-fangs there are some smaller grooved teeth in the maxillary bones; there are three such teeth in the *Bungarus pama*, and five in the *Bungarus annulatus*. In the Hamadryas, or great hooded poisonous tree snake of India, the venom-fang is relatively as large as in the typical poisonous serpents, but three or four

smaller grooved teeth are implanted behind it on the maxillary bone.*

In the majority of the Saurian reptiles the teeth are confined to the margins of the jaws, but in some teeth are also placed upon the palate, not, however, supported by the palatine, but by the pterygoid bones.

Amongst the Scincoid or smooth scaled lizards, one genus inhabiting Australia has received the name of Cyclodus,† or circular toothed, from the subhemispherical form of the teeth, which as they are worn away assume a tubercular instead of a conical form.

Fig. 4.



Half the base of the skull of the *Iguana tuberculata*: *a*, intermaxillary bone; *b*, maxillary; *c*, palatine; *d*, pterygoid supporting teeth.

The Iguanidæ, which have already been referred to as examples of vegetable feeding lizards, constitute an extensive family inhabiting both the

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* "Odontography." By R. Owen, F.R.S. p. 228. London, 1840-1845.

† Gr. *kuklos*, a circle; *odous*.

Old and the New World. These animals are distinguished by the presence of a membranous expansion or pouch, which hangs down from the under surface of the throat, forming a kind of dewlap. The family is best known by the common *Iguana tuberculata*, which inhabits the greater part of South America and attains a length of four or five feet.

MM. Dumeril and Bibron have divided this family into two great sections, which are distinguished by the manner in which the teeth are attached to the jaw bones, this distinction also corresponding to their geographical distribution.

In the one, and it is that containing the largest number of species; the teeth are lodged in a common alveolar groove and are united by their basis to the inner surface of the outer wall of the groove in the maxillary bones; these are the *pleurodont* * Iguanians. The majority of the pleurodonts are further distinguished by the possession of pterygoid teeth; † a smaller number have the palate edentulous; ‡ they are all inhabitants of America.

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* Gr. *pleuron*, the side; *odous*.

† According to MM. Dumeril and Bibron the following genera possess pterygoid teeth: *Polychrus*, *Urostrophus*, *Amblyrhynchus*, *Iguana*, *Metopoceros*, *Cyclurus*, *Brachylophus*, *Leiosaurus*, *Hypsibates*, *Proctotretes*, *Ecphymotes*, *Stenocerus*, *Oplurus*, *Anolis*, *Corythophanes*, *Basiliscus*, and *Aplophonotus*.

‡ The following genera have no pterygoid teeth: *Hyperanodon*, *Tropidolepis*, *Phrynosoma*, and *Callisauros*.

In the other division the teeth are anchylosed to the summit of the alveolar ridge of the jaw, and are termed *acrodonts*.*

The Iguanidæ present another well-marked example of the value of the dental characters in determining the nature and alliances of certain extinct animals. The late Dr. Mantell, in the course of his investigations of the sandstone of the Tilgate forest, discovered, amongst other fossils, some teeth, which were distinct from any that had previously come under his notice, and which he was unable to identify with those of any living animal. Specimens of these teeth were transmitted to Baron Cuvier, and his reply to Dr. Mantell was to the effect that the teeth were unknown to him, that they certainly did not belong to a carnivorous animal, and that judging from their simple form, the notching at the edge, and the thin layer of enamel with which they were invested, that they were reptilian. Have we not here, he asks, a new animal, an herbivorous reptile, and as amongst the existing terrestial mammals the herbivorous species are the largest, so with the reptiles in former times, when they were the only terrestrial animals, would not the largest amongst them be vegetable feeders?

Pursuing his inquiries in this direction, on comparing the fossil teeth with those of the

* Gr. *akros*, the summit; *odous*.

existing Iguana, he found that they possessed the same form and structure.

"Like the teeth of the recent Iguana, the crown of the tooth is acuminated; the edges are strongly serrated or dentated, the outer surface is ridged, and the inner smooth and convex; and, as in that animal, the secondary teeth appear to have been formed in a hollow in the base of the primary ones, which they expelled as they increased in size." *

Guided by the dental characters, Dr. Mantell bestowed upon the extinct reptile the title of Iguanodon.† This gigantic creature, whose total length has been estimated at seventy feet, of which the tail occupied fifty-two feet, was an inhabitant of the geological strata, which are met with in the Wealds of Kent and Sussex. These deposits appear to have been formed in a brackish estuary where a coarse but abundant vegetation prevailed. The teeth of the Iguanodon were well adapted to crushing this kind of vegetable food; and the articulation of the lower jaw indicates a true act of mastication, the glenoid cavity being so constructed as to allow of a horizontal movement of the jaw, by which the irregular surface of the antagonizing teeth were drawn across each

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* Philosophical Transactions, 1825. Mr. Mantell. Notice on the Iguanodon.

† Gr. *iguana* and *odous*.

other; while the size of the foramina, through which the nerves of the face passed out, show that the animal was provided with more muscular and better developed cheeks and lips than any existing crocodiles or lizards,* conditions which must have greatly facilitated the thorough mastication of its vegetable food.

The family of the Lacertidæ, or true lizards, represented in this country by the small sand lizard, *Lacerta agilis*, which is usually about seven inches in length, and by the viviparous lizard, *Zootika vivipara*, which is usually somewhat smaller, have been divided by Bibron into two groups, distinguished from each other by the construction of the teeth.

In the first group the teeth are solid, having no cavity in their interior, and are firmly anchylosed by their base to the alveolar groove, upon the inner side of the jaw; these constitute the *pleodont*,† or full-toothed lacertians.

In the second group the teeth are excavated by a kind of canal, and are attached to the outer alveolar wall, but do not adhere by their base: these constitute the *cælodont*,‡ or hollow-toothed lacertians.

Allied to the lizards is the extraordinary race

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* *See* Pictet's Paléontologie, vol. i., p. 471.

† Gr. *pleos*, full; *odous*.

‡ Gr. *koilos*, hollow; *odous*.

of extinct reptiles, the Pterodactyles, which were endowed with the power of flight by means of true wings. These animals, when their remains were first discovered, were placed by different naturalists amongst the birds, the mammalia, and the reptiles, to the latter of which they are now universally admitted to belong. Here, again, as in so many other instances, the characters of the teeth served to guide Cuvier to a correct determination of the nature of the animal. "The teeth," says this writer, "by which the examination of an animal should always commence, here present nothing equivocal. They are all simple, conical, and closely resemble each other, as in the crocodiles, the monitors, and other lizards."*

The last division of the reptiles is that containing the crocodiles. It was seen that in the lacertian reptiles the teeth were reduced in number, and, as a rule, confined to the margins of the jaws. In the present division the only bones which support teeth are the pre-maxillaries and the maxillaries in the upper jaw, and the premandibular portion of the lower jaw. The teeth do not vary in number to the same extent as in the previous orders. In the individual the teeth will vary in number, within certain limits, in consequence of the constant loss and reproduction

* Ossem. foss. Ed. 1836, tom. x., p. 225.

which go on throughout the life of the animal, but the entire number of teeth that can be in use at the same time is definitely fixed. The teeth are no longer anchylosed to the jaws, or contained in an open alveolar groove, but each is received into its separate compartment or socket. They are of a conical form, somewhat recurved, and have often a sharp anterior and posterior edge. The surface is marked by longitudinal grooves and ridges; and, when the mouth is closed, those of the two jaws interlock. The teeth of the Crocodiles and Alligators are relatively larger than those of the Gavials.

The Crocodilia may be subdivided into three sections, consisting of the true Crocodiles, the Alligators, and the Gavials: these may be distinguished from each other by the form and proportions of the head, and by certain characters presented by the teeth. "The best and most readily recognisable characters by which the existing Crocodilians are grouped in appropriate genera are derived from modifications of the dental systems." *

The true Crocodiles, of which the Crocodile of the Nile, *Crocodilus vulgaris* (fig. 5), is the most familiar, have the snout oblong, obtuse, and flattened. The *first* tooth (1) in the lower jaw perforates the palatine process of the intermaxil-

* Owen, *opus cit.*, p. 286.

lary bone when the mouth is closed; while the *fourth* tooth (4) is received into a notch in the

Fig. 5.

Skull of Crocodile: 1, large anterior tooth, received into a pit or perforation of the upper jaw; 4, received into a groove in the upper jaw, and visible when the mouth is closed; 3 and 9 mark the largest teeth in the upper jaw.

side of the alveolar margin of the upper jaw, and is *visible* when the mouth is closed.

In the Gavials (fig. 6) the jaws are elongated and slender; the teeth are numerous, of nearly

Fig. 6.

Skull of a Gavial: *a*, fourth tooth of lower jaw, received into a notch of the upper jaw when the mouth is closed.

equal size and similar form in both jaws, and both

the *first* and *fourth* tooth (*a*) pass into a *groove* in the margin of the upper jaw when the mouth is closed.

The Alligators have the snout broad and obtuse, and both the *first* and *fourth* teeth of the lower jaw are received into a pit or perforation on the palatal surface of the upper jaw, where the latter is *concealed* when the mouth is closed.

In the true Crocodiles and in the Alligators certain teeth are larger than the others; and by this means the different species—determined, however, by other characters than those derived from the teeth—may be distingished. The following dental formulæ, taken from Owen's "Odontography," p. 287, give the number of teeth in each jaw, distinguishing those which are the largest in two species of alligators and in two species of crocodiles :—

Alligator palpebrosus $\frac{19-19}{21-21}=80\,\frac{2,5,7,10}{1-4}$ largest.

Alligator lucius $\frac{20-20}{20-20}=80\,\frac{4,5,8,9,10}{1,3,4,11,12,13}$ largest.

Crocodilus vulgaris $\frac{18-18}{15-15}=66\,\frac{3-9}{1,4,11}$ largest.—*See* fig. 5.

Crocodilus bifurcatus $\frac{18-18}{15-15}$ or $19-19=66$ or $68\,\frac{2,3,8,9}{1,4}$ largest.

The result arrived at from this survey of the dental characters belonging to the class Pisces, and to the several orders of the Reptilia, may be briefly summed up by saying: that, from being very numerous and attached to all the bones which

enter into the formation of the floor and roof of the mouth, those forming the base of the skull, and those surrounding the entrance to the œsophagus, they have become restricted to the margins of the jaws; and from being mere repetitions the one of the other, and indefinite in number, they are now limited, and are beginning to assume special and distinctive characters by which certain teeth may be distinguished from the rest of the series, and assigned to a particular position in the jaws. The teeth are no longer lodged in an open groove, or attached by anchylosis or by ligament to their supporting bones, but each is provided with its separate socket; and, while at first they enabled the naturalist to do little more than predicate the class to which the animal belonged, it is now possible, within certain limits, to determine not only the class, order, and family, but even the species to which the individual belonged. It must, however, be understood that the characters derived from the teeth in the present classes do not possess that general application which is necessary in those upon which the primary divisions of a class are based. We must, therefore, be content to adopt those divisions in the arrangement of the museum which have been established by the naturalist on other grounds, but at the same time give prominence to those dental peculiarities which have just been pointed out.

The class Mammalia, which has now to be examined, contains the most highly organised members of the animal kingdom—those which are endowed with the most numerous faculties, and possess the greatest amount of intelligence. These animals are distinguished by the female having two or more mammary glands, whose office is to secrete the milk upon which the young are nourished at the period of birth, and for some time after.

The majority of these animals are inhabitants of the land, where some pursue a living prey, or devour the decaying remains of the dead; the smaller and feebler species feed upon the multitudinous tribes of insects; others are vegetable feeders; and some partake of a mixed diet of animal and vegetable food, corresponding to what are commonly termed the carnivorous, insectivorous, herbivorous, and omnivorous races. Others of the Mammalia are adapted to an aërial existence, while some live exclusively in the water; both of these divisions may be divided into animal feeders and vegetable feeders. Another series lead a kind of amphibious life, residing sometimes in the water and sometimes on the land, so that the Mammalia are adapted to every mode of life that is met with in the fish, the reptile, or the bird.

As the nature of the food varies, so do the characters of the teeth. And, as the general

structure and organization of an animal is modified in accordance with its habits of life, then, since the principal occupation of the irresponsible and unreasoning animal is to provide itself or its young with food, it is evident how greatly its general structure must also be influenced by that pursuit which fills up the greater part of its existence. If the teeth are modified in accordance with the food; and if the general structure of the animal is also governed by the same condition, then it will almost follow as a matter of necessity, that the one must become the index to the other, and that consequently from the character of the teeth the rest of the organization may in a great measure be inferred. It is this correlation of structure which affords the clue to the paleontologist by which he is able to unravel the history of those fragments of animal life which have been aptly termed the "medals of creation."

In all the Mammalia, when the teeth are present, they are confined to the premaxillary, maxillary, and mandibular bones.

In the Cetacea, which resemble the fish in their mode of life, and in some of the lower forms of the terrestrial mammals, such as the Armadillos, the teeth are uniform in their appearance, and excessive in number,* presenting an example of that kind of

* Some of the Armadillos have as many as eighty or ninety teeth. In a specimen of the *Priodontes gigas*, in the College of

vegetative or irrelative repetition, which has been already referred to as indicating, either a low grade of development in the individual, or an imperfect condition of the organ. In the remainder of the class the teeth never exceed forty-four in the Placental,* or fifty-four in the Implacental† division.

The majority of the Mammalia are furnished with two sets of teeth, and these Professor Owen

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Surgeons, the writer counted seventy-eight teeth in the two jaws. In the true Dolphins (*Delphinus*) there are as many as from one hundred to one hundred and ninety teeth, the latter number being present in the common Dolphin (*Delphinus delphis*). These teeth are not placed in separate sockets, but, like those of the lower vertebrata, are contained in an open groove; and when the gum is stripped off, the teeth come with it.

* Amongst existing animals this number is present in the common Hog (*Sus scrofa*, fig. 10); it is regarded as representing the typical number of teeth belonging to this division of the Mammalia, and was present in the *Anoplotherium* (fig. 14), and in a large number of extinct animals. In addition to this, in the *Anoplotherium* the teeth formed a continuous series in both jaws, without any break or interval between them, a character which is now confined to man. The following is the typical dental formula of the Placentalia:

$$\text{In. } \frac{3-3}{3-3}\text{; c. } \frac{1-1}{1-1}\text{; p. } \frac{4-4}{4-4}\text{; m. } \frac{3-3}{3-3} = 44.$$

† This number is met with in the *Myrmecobius fasciatus* of Waterhouse, the only existing representative of the family. The dental formula is,—

$$\text{In. } \frac{4-4}{3-3}\text{; c. } \frac{1-1}{1-1}\text{; p. } \frac{3-3}{3-3}\text{; m. } \frac{6-6}{6-6} = 54.$$

has named the Diphyodont* mammalia. The few that have only one set he terms Monophyodont† mammalia.

The teeth no longer resemble each other, but assume special forms and functions, and, what is of no less importance, hold distinct positions in the jaw bones, by which they can be homologically determined in the different animals; also in the same animal, first in regard to the upper and lower jaws; and, secondly, in regard to the two sides of the same jaw.‡ The mode of development and the order of succession have also an im-

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* Gr. *dis*, twice; *phuo*, I generate; *odous*.

† Gr. *monos*, once; *phuo* and *odous*. Professor Owen included in his monophyodonts the orders *Monotremata*, *Bruta*, and the true *Cetacea;* but Mr. Flower has recently shown that the common nine-banded Armadillo—*Tatusia peba*, Desm.—is furnished with two sets of teeth. In a fœtal specimen he found the germs of seven milk teeth in both jaws.—*Proceed. Zool. Soc.*, June 11th, 1868.

‡ In a paper "On the Nomenclature of the Mammalian Teeth," by Mr. H. N. Moseley, B.A., and Mr. E. Ray Lankester, first read at the meeting of the British Association at Norwich, and since published in the *Journal of Anatomy and Physiology* for November, 1868, the homologies and nomenclature of the teeth, as at present received, are called in question. The subject is one of too much importance, and would occupy too much space, to be discussed within the limits of a note. I cannot, however, think that their objections, except in a few isolated cases, are valid, or that on account of these zoologists will forego the advantages of a more definite dental nomenclature than the one they propose to substitute for our present system.

portant bearing upon the homologies of the teeth. From these peculiarities the teeth of the Mammalia have been divided into four series, which have received the names of incisors, canines, pre-molars, and molars. These names, with the exception of the term pre-molar, were originally derived from the form or function of the teeth, but are now arbitrarily applied to the teeth situated in certain parts of the maxillary bones, whatever their form or function may be.

The term incisor, applied in the first instance to teeth adapted for cutting, is now given to all teeth situated in the pre-maxillary bones, and in the corresponding portion of the lower jaw. Thus the tusks of the Elephant, although weapons of attack and defence, and in no way connected with the food, further than as they may be employed to uproot the trees upon whose foliage the animal feeds, are nevertheless termed incisors, because they are situated in the pre-maxillary bones.

The term canine, derived from the circumstance that these teeth are largely developed in the dog, and are highly characteristic of the feline tribe, is always applied to the *first* tooth succeeding the incisors, which is situated in the maxillary bone.

The name of pre-molar—the bicuspid of the human anatomist—is given to those teeth which take the place of the molar teeth of the temporary

set; * they are also termed "false molars" and "small molars;" they are placed in the maxillary bones between the canines and the true molars. These teeth are never more than four in number on each side of the jaw and frequently one or two of them are suppressed; they are numbered from before backwards, and when any of them are suppressed it is the first or second; the third and fourth, or the two in front of the first true molar, being the most constant.†

The term molar is applied to the teeth situated at the back of the mouth, and are superadded to those which take the place of the temporary teeth. There may be only two, but there are never more than three on each side of the jaws in the Placental division of the Mammalia. When these teeth are below the typical number it is the posterior that are suppressed.‡

The pre-molars and the molars are usually im-

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* Some of the teeth which have received the name of pre-molars have no milk predecessors, as has been shown by Mr. Flower in the case of the Dog and the Pig. The same thing occurs in the Badger, as stated by Mr. H. M. Moseley and Mr. E. R. Lankester in the paper just referred to.

† See the article "Teeth," in the "Cyclopædia of Anatomy and Physiology," vol. iv., page 903. Mr. Flower, in a paper, read at the last meeting of the British Association, "On the Homologies and Notation of the Teeth of Mammalia," stated that it is not always the case that when the pre-molars fall short of the typical number the absent ones are from the fore part of the series.

‡ *Ibid.*

planted in the jaw bones by two or more roots, which are received into distinct sockets. This character is peculiar to the Mammalia, and is therefore an important guide to the paleontologist in determining the nature of a fossil in which it is present.

In consequence of the intimate relation which has been shown to exist in the Mammalia between the teeth, the food, and the general structure of the animal, the definite position the different kinds of teeth hold in the pre-maxillary, maxillary, and mandibular bones, and the mode in which the two sets of teeth succeed each other, these organs are of the utmost importance for the purpose of defining the different families, and also of grouping them together.

Aristotle, in his "Natural History of Animals," makes frequent reference to the teeth, and establishes some important generalizations in regard to these organs. He recognizes three kinds of teeth, and mentions that those which are called canine teeth are placed between the cutting and the molar teeth.* Again, he observes, animals which have horns do not possess teeth in both jaws, for they have no front teeth in their upper jaw; while no animal has both tusks and horns.†

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* "Aristotle's History of Animals," translated by R. Cresswell, M.A., p. 31, ¶ 13. London, 1862.

† Opus cit., p. 30, ¶ 9.

Animals that have not cutting teeth in both jaws ruminate, as the Ox, Sheep, and Goat;* and amongst viviparous quadrupeds, those that are wild and have pointed teeth are all carnivorous.†

These statements indicate an extensive and accurate knowledge of the teeth of the Mammalia, for without it the writer could not have arrived at those general laws whose correctness the researches of subsequent observers have only served to confirm. Aristotle, to a certain extent, also made use of the teeth for the purpose of classification.‡ He divided his Zootoka, which were equivalent to our Mammalia, according to the nature of their locomotive organs, into the Dipoda, or two-footed; the Tetrapoda, or four-footed; and into the Apoda, or footless animals; the latter corresponding to the Cetacea.

The Tetrapoda, or quadrupeds, were further subdivided into two great groups, distinguished by the characters of the extremities; these corresponded to what are now known as the Unguiculata, or animals whose digits are furnished with nails, and into the Ungulata, or those which are provided with hoofs.

The further division of the Unguiculata was

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* Opus cit., p. 278, ¶ 6.

† Opus cit., p. 204, chap. vii., ¶ 1.

‡ The following account of Aristotle's classification is taken from the article Mammalia, "Cyclopædia of Anatomy and Physiology," vol. iii., p. 284.

based upon the characters of the teeth. The first group consisted of those Unguiculates which have the front teeth terminating in a cutting edge, and the back teeth with a flattened or triturating surface, as in the case of the Apes and the Bats. The second group was composed of animals provided with pointed canine or carnivorous teeth. The animals corresponding to the order Rodentia were characterised by the absence of the canines.

This arrangement will be best seen by presenting it in a tabular form.

ARISTOTLE'S ARRANGEMENT OF THE ZOOTOKA OR MAMMALIA.

Dipoda	... ...		Homo.
Tetrapoda	Unguiculata	Front teeth cutting, back teeth triturating	Quadrumana.
			Cheiroptera.
		Teeth acuminated or carnivorous	Carnivora.
		Canines absent	Rodentia.
	Ungulata	... ...	Pachydermata, &c.
Apoda	... ...		Cetacea.

No advance was made in zoological classification from the time of Aristotle until that of Ray, to whom we are indebted for the first improvement during this long interval of more than two thousand years. Ray's classification related only to the Mammalia with four feet, the Cetacea being

classed with the fish, an error which Aristotle had avoided.

Like Aristotle, the English naturalist selected the limbs as the basis of his classification, and divided the quadrupeds into the Ungulata or hoofed animals, and into the Unguiculata, or those having nails or claws. Amongst the latter he distinguishes the Carnivora, as having many incisors, and the Rodentia, as having two very large incisors.

The following table exhibits Ray's arrangement of the Unguiculate division of the Mammalia.

UNGUICULATA.*

(HAVING NAILS OR CLAWS.)

BIFID (Ruminantia).—The foot cleft in two, as the Camel.

MULTIFID.—The foot cleft in several parts.

With digits undivided, cohering by a common skin ; their extremities protruding only at the margin of the foot, and covered with obtuse nails, as the Elephant.

With digits somewhat separated. These are either *wide-nailed*, as the Monkeys, or *narrow-nailed*, with fore or INCISIVE teeth in each jaw.

Analoga (*Many Incisors*).—These animals are all carnivorous, or live promiscuously on insects and vegetables, as the Lion, Dog, Weasel, &c.

Two prominent Incisors.—All these are phytivorous, as the Hare, &c.

Anomola.—In these the teeth are either *absent* or *peculiar* agreeing neither in form nor disposition with the others, as the Tamandua, Hedgehog, Mole, Bat, &c.

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* "Natural History of Man and Monkeys," by W. C. Linnæus Martin, F.L.S., p. 180. London, 1841.

The classification of Ray was followed by that of Linnæus, the first edition of whose "Systema Naturæ" was published at Leyden in 1735, and of which the fifteenth edition, the last that appeared during the author's lifetime was published in 1766. The classification of Linnæus, although not free from errors, exhibits a marked advance over that of Ray. His primary subdivisions are founded on the structure of the feet; while the ordinal characters are taken almost exclusively from the teeth, of which Linnæus makes much greater use than any previous writer. At the same time it must be remarked that the Rhinoceros, the Elephant, and the Walrus cannot be associated with the order Bruta, nor do they belong to the Unguiculate subdivision of the Mammalia.

LINNÆAN ARRANGEMENT OF THE CLASS* MAMMALIA.

The primary sub-divisions founded on the structure of the feet; the ordinal characters taken from the teeth.

Sub-division 1. UNGUICULATA.

(WITH NAILS OR CLAWS.)

Order I. PRIMATES.—*Characters:* With four front incisive teeth in each of the jaws; upper four parallel and a canine on each side of both; mammæ pectoral. *Genera:* Homo, Simia, Lemur, Vespertilio. (Man, Monkey, Lemur, and Bat.)

II. BRUTA.—*Characters:* With no fore-teeth in either jaw; the feet protected by stout nails. *Genera:*

* Opus jam cit., p. 181.

Rhinoceros, Elephas, Trichicus, Bradypus, Myrmecophaga, Manis, Dasypus. (Rhinoceros, Elephant, Ant-eater, Manis, &c.)

III. Feræ.—*Characters:* With two, six, or ten, but generally six, conical front teeth in each of the jaws; one canine, separated from, and longer than, the others, on each side, in both; and the cheek teeth having conical projections; the feet armed with sharp, hooked claws. *Genera:* Phoca, Canis, Felis, Viverra, Mustela, Ursus, Didelphis, Talpa, Sorex, Erinaceus. (Seal, Dog, Lion, Bear, Mole, Hedgehog, &c.)

IV. Glires.—*Characters:* Two incisive front teeth in each of the jaws, approximated, and remote from the grinders; no canines; feet adapted for running. *Genera:* Hystrix, Lepus, Castor, Mus, Sciurus, Myoxus, Cavia, Arctomys, Dipus, Hyrax. (Hare, Beaver, Mouse, Squirrel, &c.)

Sub-divison 2. Ungulata.

(with hoofs.)

V. Pecora.—*Characters:* No incisive teeth above; six or eight below, apart from the molars. *Genera:* Camelus, Moschus, Cervus, Capra, Ovis, Bos. (Camel, Musk-deer, Deer, Goat, Sheep, Ox.)

VI. Belluæ.—*Characters:* Incisive teeth, obtuse and truncate. *Genera:* Equus, Hippopotamus, Sus, Rhinoceros. (Horse, Hippopotamus, Hog, Rhinoceros.)

Sub-division 3. Mutica.

(with feet like fins for swimming.)

VII. Cete.—*Characters:* Teeth in some horny, in others bony; spiracles on the top of the head, pectoral fins in place of feet, and a horizontal flattened tail.—*Genera:* Monodon, Balæna, Physeter, Delphinus. (Monodon, Whale, Cachalot, Dolphin.)

The last classification which will be given is that of Baron Cuvier, as published in the second edition of the "Règne Animal." Like Linnæus, Cuvier employs the modifications of the extremities upon which to found his primary divisions of the Mammalia, and separates them into the Unguiculata, Ungulata, and Mutica.

The orders, which are nine in number, are established upon various anatomical distinctions, amongst which the characters of the teeth hold a prominent and important position. But, besides making use of the teeth to distinguish the orders and families into which he has divided the Mammalia, Cuvier has also employed them for the purpose of grouping together the different orders belonging to the Unguiculata into three sections, distinguished from each other by the number and characters of the teeth. The following table exhibits the results of Cuvier's arrangement; but it has not been thought necessary to give in detail the use he has made of the dental characters in defining the different orders and families into which his primary groups are subdivided.

MAMMALIA.

Unguiculata	With three kinds of teeth	Bimana.	
		Quadrumana.	
		Carnivora	Cheiroptera.
			Insectivora.
			Carnivora.
		Marsupialia.	
	Without canines	Rodentia.	
	Without incisors	Edentata.	
Ungulata	Non-ruminants	Pachydermata.	
	Ruminants ...	Ruminantia.	
Mutica		Cetacea	Herbivora.
			Cetacea.

Such is the use which some of the most distinguished naturalists have made of the teeth, for the purpose of defining and classifying the families of the Mammalia up to the time of Cuvier. The more accurate and extended knowledge which has been obtained since that period of the Marsupial animals, and also of the Monotremes, animals which Cuvier arranged with the Edentata, has necessitated an entire revision of his classification, which has resulted in the Mammalia being subdivided into three great groups or subdivisions, based upon the peculiar modifications of the reproductive organs in the female. These are the Monodelphia or Placentalia, containing the ordinary forms of mammalian life; the Didelphia, or Implacentalia, which contains the Marsupial

or pouched animals; and the Ornithodelphia or Monotremes, which includes those peculiar animals, the Echidna and the Ornithorynchus.

In a paper read before the Linnæan Society in February, 1857, Professor Owen proposed to subdivide the Mammalia according to the characters presented by the brain. The resulting classification cannot be said to have been favourably received; nor does it lead to such an arrangement of the orders as is in accordance with the expressed views of naturalists in general; in addition to which there are many instances where it would be very difficult to determine from the character of the brain alone, to which of the proposed divisions the animal belongs.

Professor Huxley,* in one of his lectures, delivered in the theatre of the Royal College of Surgeons, and entitled, "The Sub-divisions of the Mammalia larger than Orders," after adopting the three-fold division based upon the characters of the reproductive organs, proposes to adopt the structural peculiarities of the placenta as a means of grouping together the different orders which compose the Monodelphia or placental division of the Mammalia. Striking and interesting as are some of the results arrived at from the investigations of the embryologist,

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* "Elements of Comparative Anatomy," p. 87. By T. H. Huxley, F.R.S. London, 1864.

they cannot be said, at least in the present state of our knowledge, to lead to sufficiently uniform and definite results; nor have they, any more than the cerebral characters, been generally accepted.

There is one very obvious and practical objection to the adoption of such anatomical and structural peculiarities as a basis of classification, namely, that in the case of a newly discovered animal it is only after careful dissection we can positively assert in which group, or subdivision, it should be placed. In the case of the placental classification, this involves the dissection of the impregnated female.

The more easily a character can be ascertained and recognised, the more permanent and enduring its nature, the more intimate and extensive its connection with the general structure of the animal, the better it is adapted for the purposes of the comparative anatomist, the naturalist and the paleontologist. No part of the animal possesses these qualities in a greater degree than the teeth; and with these advantages it remains to be seen whether they can be employed for the purpose of grouping together the different orders of the placental division of the Mammalia in a convenient and natural manner.

I have endeavoured to do this by dividing the Placentalia into three groups or sub-divisions, to

which I have given the names of Monoidodonts,* Diidodonts,† and Triidodonts,‡ or those having one kind of teeth, two kinds of teeth, and three kinds of teeth. I must, however, repeat what I have previously remarked that no single character will afford the basis for a perfectly natural classification, and, therefore, certain exceptions will be met with, but I do not think that they are either more marked or more numerous than those which arise from a cerebral or placental classification.

ARRANGEMENT OF THE PLACENTAL MAMMALIA FROM THE CHARACTER OF THE TEETH.

- Mammalia
  - Placentalia
    - Triidodonts
      - Bimana.
      - Quadrumana.
      - Cheiroptera.
      - Insectivora.
      - Carnivora.
      - Ruminantia.
      - Pachydermata.
    - Diidodonts
      - Rhinocerina.
      - Rodentia.
      - Proboscidia.
      - Sirenia.
    - Monoidodonts
      - Cetacea.
      - Bruta.
  - Implacentalia. Marsupialia.
  - Ornithodelphia. Monotremata.

* Gr. *monos*, one ; *eidos*, kind ; *odous*, a tooth.

† Gr. *di*, two ; *eidos* and *odous*.

‡ Gr. *treis*, three ; *eidos* and *odous*.

In the Monoidodonts the teeth are either absent or are of one kind only, consisting of those which

FIG. 7.

Jaw of Dolphin, showing the type of the Monoidodont dentition.

are developed in the maxillary bones and in the corresponding portion of the lower jaw. This division contains two orders, Bruta and Cetacea.

The order Bruta includes the Ant-eater (*Myrmecophaga*, Lin.), the Scaly Ant-eaters or Pangolins (*Manis*, Lin.)—these are edentulous—the Armadillos (*Dasypus*, Lin.), the Orycterope or Cape Ant-eater (*Orycteropus*, Geof.), the Sloths (*Bradypus*, Lin.), together with the extinct Megatherium, Mylodon, Glyptodon, and some other allied forms which have been found in the diluvial deposits of the American continent.

In this order we meet with the following exceptions to the dental characters assigned to the group. In the existing genus Dysapus of F. Cuvier, the first tooth in the upper jaw is placed in the intermaxillary bone, while the two first in the lower jaw close in front of it; these teeth must therefore be regarded as incisors. In the extinct Chlamydotherium, the two anterior teeth in the upper jaw, and the three anterior in the

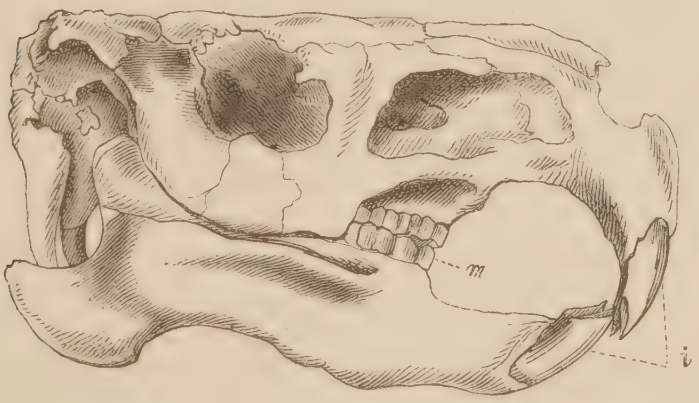
lower jaw, are, by position, incisors. So also in the Glyptodon a fragment of the lower jaw shows that the teeth extended to the symphysis, and there is, therefore, every probability that teeth were present in the intermaxillary bone. In the Unau, or Two-toed Sloth (*Bradypus didactylus*, Lin.), the first tooth in the upper jaw is placed close to the intermaxillary suture, is separated by a considerable interval from the other teeth, and has a pointed form. It is the same in regard to the first tooth in the lower jaw, and both—it cannot be said incorrectly—have been termed canines; but at the same time it is to be observed, that the upper tooth closes in front of the lower, an arrangement which is the reverse of what usually occurs in other animals, where the lower canine always passes either in front or to the inside of the corresponding tooth of the upper jaw. Practically, even these exceptions could scarcely be a source of error, inasmuch as the simple form and uniform appearance of the molar teeth would clearly indicate the natural affinities of the animals.

In the Cetacea the teeth are of a conical form, and are placed in the maxillary bones and in the corresponding portion of the lower jaw. In the Spermaceti Whale (*Physeter macrocephalus*) the teeth are confined to the lower jaw. The same thing occurs in the Great Bottle-nosed Whale (*Hyperoodon*), and some others in which the teeth

are reduced to two in number. The Whale-bone Whale (*Balæna mysticetus*) is edentulous and is provided with plates of whalebone in the place of teeth; but even these animals, as was first shown by Geoffroy St. Hilaire, have the germs of teeth developed in the open groove of the jaw bone during the fœtal state. In the Narwhal, or *Monodon*, a simple, long, spirally twisted tusk is developed in the male animal on the left side, which is lodged in the intermaxillary bone,* and is, therefore, an incisor; but, with this exception, the remainder of the order conforms to the definition of the group.

In the Diidodonts only two kinds of teeth are

Fig 8.



Skull of Capabyra, showing the type of the Diidodont dentition; *i.* incisors, *m.* molars.

* Very rarely both the right and left tusks are developed in the male. A specimen of this kind is contained in the museum at Amsterdam. In the female the development of both tusks is arrested at an early period of their growth, and they remain concealed in the intermaxillary bones, fully ossified, but functionless teeth.

present, namely, Incisors and Molars. These teeth are separated by a considerable interval from each other, the canines never being developed in the animals which compose the orders belonging to this group. This division includes the Sirenia, or herbivorous Cetacea, the Proboscidia, the Rodentia, and what I have ventured to term the order Rhinocerina, and of which more will be said presently.

The Sirenia, or herbivorous Cetacea, consist of the Manatees and the Dugong. The dentition of these animals is somewhat peculiar and irregular. In the young Manatee, a single deciduous tooth is developed in each intermaxillary bone; but when this falls out it is not succeeded by another. In the Dugong two incisors are developed in the upper jaw of the male, so as to project from the gum; but in the female the development of these teeth is arrested, and they remain concealed in the jawbone. The molar teeth succeed each other from behind forwards in the same manner as in the Proboscidia, and thus manifest the affinity of the Sirenia to the Elephants and Mastodons, next to which they are placed in the table.

In one species, *Rhytina Stelleri*, now supposed to be extinct, but which only disappeared at the close of the last century, the teeth were absent, and in their place the animal was provided with a pair of bony plates in the anterior portion of

the mouth, one of which was attached to the palate, the other to the lower jaw.

The transition from the herbivorous Cetacea to the large terrestrial Proboscidia is accomplished by means of the extinct *Dinotherium*. These animals were provided with a proboscis. There were no incisor teeth in the upper jaw, but a series of five molar teeth in each maxillary bone; the three true molars being characterised by transverse ridges, similar to those that are seen in the molars of the Tapir. The most characteristic portion of the skull is the lower jaw, which at its anterior portion and at the symphysis is deflected, and supports two long curved tusks that are directed downwards. The largest species, the *Dinotherium giganteus*, is estimated to have measured eighteen feet in length, and exceeded the size of the largest fossil Elephant. The Dinotheres, like the Hippopotami, were semi-aquatic. Their peculiar tusks served as weapons of defence, for the purpose of digging, and probably assisted them to ascend the banks of the freshwater lakes and rivers, which they frequented during the middle portion of the Tertiary period. The form of the occipital bone, says Dr. Buckland, approximates to that of the Cetacea, the Dinotherium in this structure affording a new and important link between the Cetacea and the Pachydermata. In the Elephant only the upper jaw is furnished with

tusks; but it is interesting to find that in the male of some species of Mastodon (*Mastodon angustidens*) there were also two tusks in the lower jaw.

In regard to the succession of the orders, I would observe that both Bruta and the Cetacea have been placed at the bottom of the Placentalia by previous writers; while De Blainville, although he gave them a higher position in the series, associated them together under the common title of Edentata: distinguishing the Bruta as *normal*, and the Cetacea as *abnormal* Edentata.

The connection which is admitted to exist between the Sirenia and the Cetacea is clearly indicated by their familiar title of "herbivorous Cetacea," and both Cuvier and Illiger formed them into one order. I have just pointed out some of the characters by which the Sirenia are linked to the Proboscidia; a union which was adopted by Professor Owen in his first, but abandoned by him in his last, published classification of the Mammalia. De Blainville, a writer of no mean authority, constituted his order *Gravigrade* for their reception. The position of the Sirenia in the present arrangement serves to indicate their alliance to the true Cetacea, but associates them with the Proboscidia, to which they would appear to be most closely allied.

The position of the Rodentia, next to the

Proboscidia, is an evident innovation upon the linear arrangement that has been generally adopted of the orders belonging to the Placentalia, but it is one which I believe may easily be justified. The connection existing between the two orders has been recognised since the time of Cuvier, who, when describing the skull of the Pachydermata, says, "The head of the Elephant is intimately related to that of the Rodentia. The size of the intermaxillary bones, the position of the maxillary bones, that of the malar bone and its connections are the same."* It would appear from the remarks of Professor Huxley, that the same association of the Rodentia with the Proboscidia would result from the adoption of a placental classification; and I cannot urge a stronger argument in favour of the present arrangement than by quoting the following passage from the lecture already referred to:—"So far as the case of the Elephants is concerned, I must confess that I see no difficulty in the way of an arrangement which unites the *Proboscidia* more closely with the *Rodentia* than with the *Artiodactyla* and *Perissodactyla*; the singular ties which unite the Elephants with the Rodentia having been a matter of common remark since the days of Cuvier." †

The Rodentia (fig. 9) are always provided with

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* Leçons d'Anatomie Comparée, vol. ii., p. 427; Paris, 1837.

† Opus cit., p. 111.

two scalpriform incisors in both jaws. Only in the case of the Leporidæ two additional and diminutive incisors are developed immediately behind those of the upper jaw.

The next and only other change which has been made in the usual plan of classification, and in the succession of the different orders, is that of raising the family Rhinoceridæ, which is generally classed with the Pachyderms, to the rank of a distinct order, dividing it into the following families and genera. Those printed in italics are fossils.

Order.	Family.	Genera.
Rhinocerina	Rhinoceridæ	*Elasmotherium.*
		Rhinoceros.
		Acerotherium.
	Hyracidæ	Hyrax.

As this alteration is one of importance, it is necessary to state the grounds upon which such a step has been taken. When we consider the presence of the nasal horn in the Rhinoceri—forming as distinctive, although not so influential or constant, a character, as the proboscis of the Elephant;—the strongly marked external form of the animals; the peculiarities of their dental system; and the variety of species by which they were formerly represented; and if, at the same time, such a change should offer a possible means of reconciling the conflicting opinions that have

been put forth with regard to the affinities of *Hyracidæ*, concerning which the most opposite views have been and are still entertained, at least some reasonable grounds have been shown for the change that has been made.

The Hyracidæ, of which three species are known at present, were first anatomically described by Pallas from the Cape Hyrax (*Hyrax Capensis*),

Fig. 9.

Cape Hyrax (*Hyrax Capensis*).

the only species with which he was acquainted. This animal is about the size of a small hare, and has the external form, the habits, and all the appearance of one of the Rodentia, the order in which it was placed by Pallas. Cuvier, from an examination of its anatomical characters, and more especially from the form of the molar teeth, placed it with the Rhinoceridæ; a position which has since been generally assigned to it. Professor

Huxley,* and some other naturalists, seem to regard the Hyrax as the type of a distinct order; while Professor J. F. Brandt † appears inclined to restore it to its position amongst the Rodents. In an elaborate and valuable paper by Dr. Murie‡ and Mr. St. George Mivart, "On the Muscular System of the Hyrax." At the conclusion of their paper, after mentioning certain points, "which tend rather to confirm than otherwise those ungulate affinities which have been attributed to the *Hyrax*," add: "but, on the other hand, we find so many resemblances to the Rodentia, as exemplified in the Guinea-pig (especially selected by us for comparison as the most Pachyderm-like of accessible Rodents), that we are indisposed, from the consideration of the muscular structure alone, definitely to assign the Hyrax to one or other of the *existing* orders constituting the class Mammalia."

The dentition of the Hyrax (fig. 10) consists of two incisors in the upper jaw; the number that is met with in the Rodents, and in the one-horned Rhinoceros (*Rhinoceros unicornis*); they have a triangular form, and terminate in a point. In the lower jaw the incisors project obliquely forwards, like those of the Hog; they are four in

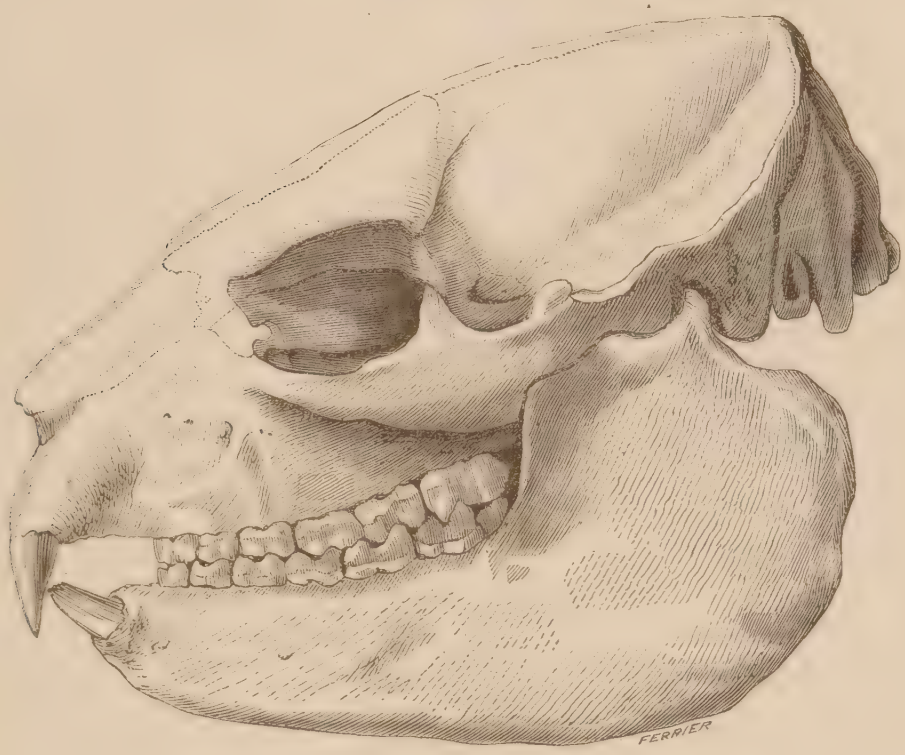
* Opus cit. p. 111.

† Bulletin de l'Académie Impériale des Sciences de St. Petersbourg, tome v, No. 7, p. 508.

‡ Proc. Zool. Soc. 1865, part ii., p. 329.

number, deviating in this respect from the Rodent type of dentition, but not more than the Leporidæ

FIG. 10.



Skull and Teeth of the Hyrax Capensis.

do by possessing four upper incisors. The construction of these teeth is the same as that of the ordinary incisors of the Mammalia, and not like that of the scalpriform incisors of the Rodentia. The molar teeth are seven in number on each side of the upper and lower jaws, resembling those of the Rhinoceros both in form and number.

In the Rhinoceridæ only incisor and molar teeth are developed; but the former are not present in all the species. It should be borne

in mind that the number and size of the horns vary in the existing species of Rhinoceros; while in the extinct species, *Rhinoceros incisivus*, and in the aberrant genus *Acerotherium* of Dr. Kaup they were absent. The presence of the incisor teeth varies with the development of the horns; just as the canines are absent in the Ruminants with persistent horns, are occasionally present in those with deciduous horns, and are well developed in those which, like the Camel and the Musk-deer, have no horns. Thus, in the two-horned Rhinoceros of Africa (*Rhinoceros bicornis*), in which the horns are large, there are no incisors in the adult animal; in the two-horned Rhinoceros of Sumatra (*Rhinoceros Sumatrensis*), where the horns are small the incisors are moderately developed. In the one-horned Rhinoceros of India (*Rhinoceros Indicus*) they are well developed, while in the extinct hornless species they attain their greatest dimensions.

It is curious, and somewhat interesting, to find this irregular development of the incisors occurring in two families; namely, the Manatees and the Rhinoceridæ; which, if the characters of the teeth are admitted as a basis of classification, are brought together into the same group; while not a single instance of a similar irregularity is to be met with in any of the orders or families belonging to the other divisions.

The normal number of incisors in the Rhinoce-

ridæ is two in each intermaxillary bone, and the same number in the corresponding portion of the lower jaw, but the late Dr. Falconer discovered a fossil species of Rhinoceros in the Himalayan Tertiary beds, in which there were six incisors in each jaw.

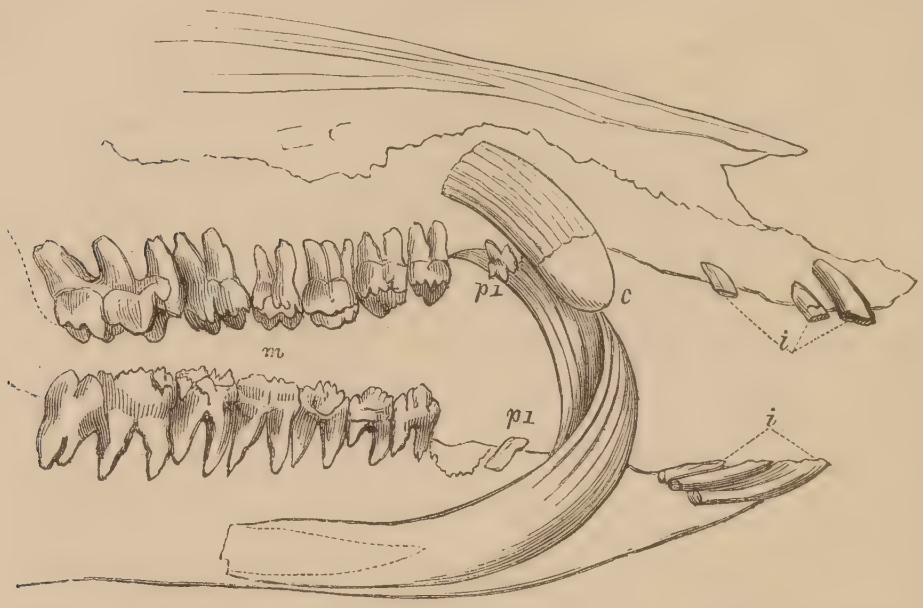
The Elasmothere is only known by a fragment of the lower jaw, containing the molar teeth which were five in number on each side. These teeth resembled those of the Rhinoceros, but the folds of enamel were more undulating, and in this respect as well as in the greater depth to which the teeth were implanted in the jaw before dividing into roots, they approximated to those of the Horse.

By adopting the proposed order Rhinocerina with its subdivisions, we have the Hyrascidæ brought into immediate proximity to the Rodentia, which they unquestionably resemble in many points, while they still remain connected with Rhinoceridæ, to which they are allied by several anatomical characters; and especially by the pattern of the molar teeth. The horned Rhinoceri constitute the typical members of the order, while the hornless species from the first transition to the Tapirs and the Elasmothere may be considered as leading to the Equidæ.

The third and last division is that of the Triidodonts, in which the three kinds of teeth, incisors, canines, and molars are all present.

This form of dentition is shown in fig. 11, representing the head of the common Hog (*Sus scrofa*). This animal has been previously men-

Fig. 11.



Dentition of the common Hog, showing the type of the Triidodont dentition. *i*, incisors. *c*, canines. *p*, pre-molars. *m*, molars. From Owen's "Odontography."

tioned (p. 104) as exhibiting the typical number of teeth belonging to the placental Mammalia, consisting of three incisors, one canine, four pre-molars,and three molars on each side of the two jaws, a number rarely met with in the existing species, but characteristic of a large number of animals that existed during the Tertiary period, and which formed so many links connecting the Suidæ with the existing Ruminantia.* This division includes seven orders.

* The following list of extinct genera which possessed the

The first of these, the Pachydermata, consist of the Hippopotami, the Equidæ, the Tapiroids, and the Suidæ. In the first and last of these families the canine teeth are developed in excess, as seen in the tusks of the Wild Boar, and in the well-known canines of the Hippopotami; in the Tapirs they are of a moderate size, while in the Horse they are small, and in the Mare rudimental.

In the majority of the Ruminants, which constitute the second order, there are no incisors in the intermaxillary, nor canines in the maxillary bones. This is the form of dentition which is met with in the hollow-horned Ruminants, consisting of the families *Bovidæ*, *Ovidæ*, *Capridæ*, and *Antelopidæ;* it also prevails in the periodically hornless Deer.

In the Deer (*Cervidæ*) canines are occasionally present in the male and sometimes also in the female; but in the latter they are smaller than in the male. In the little Muntjak (*Cervulus*

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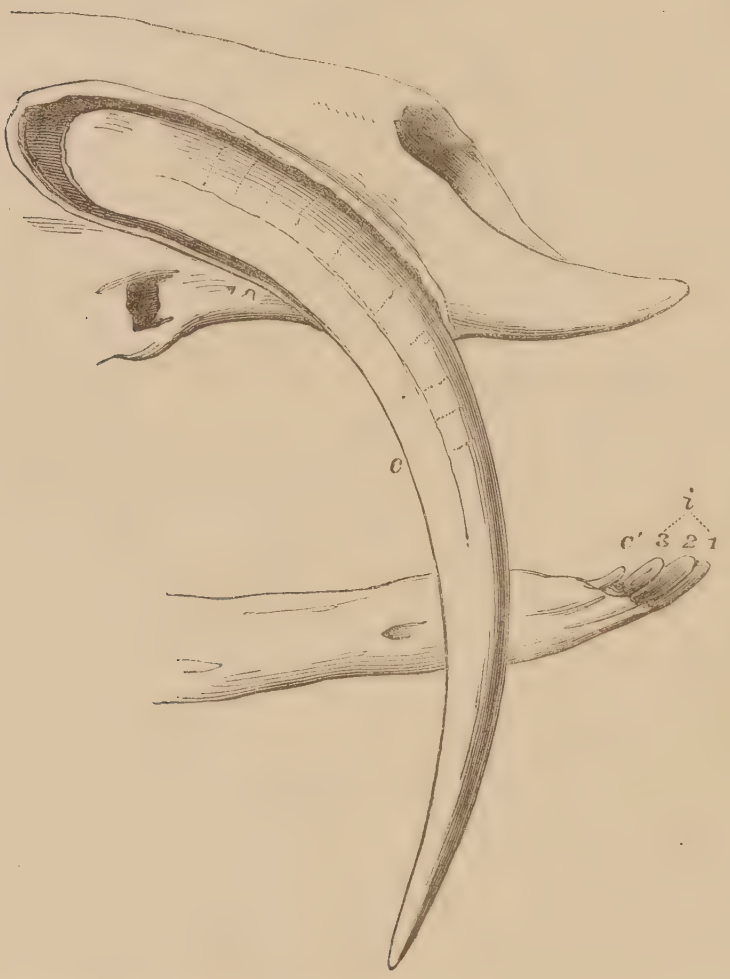
typical number of teeth is given by Professor Owen in his "Palæontology," 2nd edit., p. 361, Edinburgh, 1861:—

Palæocyon, Coryphodon, Pachynolophus, Lophiotherium, Pholophus, Hyracotherium, Palæotherium, Anoplotherium, Anchitherium, Dichobune, Ziphodon, Dichodon, Microtherium, Amphitragulus, Amphimeryx, Dorcatherium, Chalicotherium, Aphelotherium, Anthracotherium, Hyopotamus, Anchilophus, Bothriodon, Palæochrus, Chæropotamus, Chæromorus, Poëbrotherium, Hippohyus, Hippotherium, Hipparion, Heterohyus, Entelodon, Hyænodon, Pterodon, Arctocyon, Galethylax, Amphicyon, Chærotherium, Rhagatherium.

vaginalis), the canines of the upper jaw are well developed, and in the Musk-deer (*Moschus*

FIG. 12.



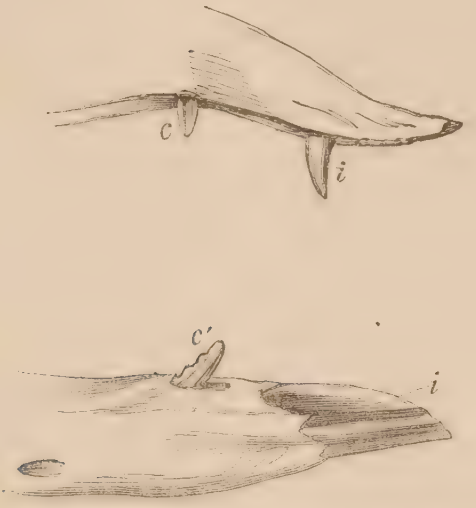
Anterior portion of the maxillary bones of the Musk-deer. *i*, 1, 2, 3, incisors. *c*, upper canine. *c'*, lower canine. After Owen.

moschiferus), (fig. 12), they form long, curved teeth, sweeping downwards from the upper jaw, and project beyond the lower when the mouth is closed.

In the *Camelidæ*, a single pointed incisor is developed in each intermaxillary bone, and a

canine in the maxillary; these teeth are feebly developed in the Llamas and Vicugnas, (fig. 13),

Fig. 13.



Anterior portion of the maxillary bones of the Vicugna (*Auchenia vicugna*). *i*, upper incisor. *c*, upper canine. *i'*, lower incisors. *c'*, lower canine. After Owen.

but assume larger and more important proportions in the Camel (*Camelus bactrianus*).

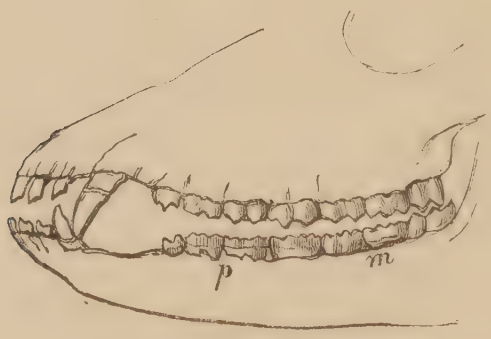
The development of the canines in the Ruminants is in an inverse proportion to that of the horns; thus they are absent in the horned ruminants, are occasionally present in some of the periodically hornless Deer, and constantly present in those species which, like the Musk-deer, Camel, Dromedary, Llamas, and Vicugnas, never have the horns developed. The same kind of relation was shown to exist between the development of the horns and of the incisor teeth of the Rhinoceri.

In the lower jaw of the Ruminants four teeth

are present on each side of the symphysis, the three innermost are incisors, corresponding to the typical number of these teeth that is present in the Placentalia. The fourth or outermost tooth, although procumbent and resembling the incisors in form, is nevertheless regarded as representing the canine. The true nature of this tooth is indicated by its late development; in many instances it has some peculiarity of form; and in the Camel, where the upper canine is well developed, it assumes a conical form, a semi-erect position, and passes in front of the corresponding tooth of the upper jaw.

A still stronger argument in favour of this interpretation of the anterior teeth of the Rumi-

Fig. 14.

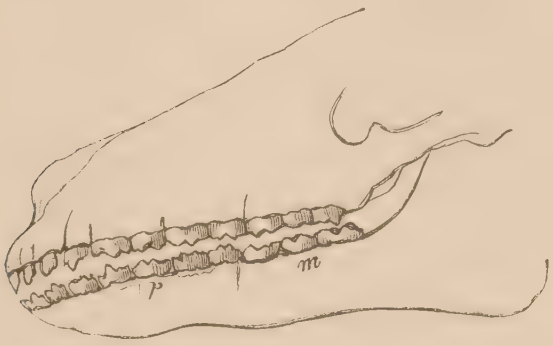


Skull of Palæotherium.

nants, is to be derived from the dentition of the Palæotherium (fig. 14), the Anoplotherium (fig. 15), and some other extinct animals which are so evidently intermediate between the Ruminants and the Suidæ, that it is difficult to say whether

the stomach was adapted for ruminating or not. In these animals incisors, canines, and molars were present in both jaws. In the Anoplotherium (fig. 15) no tooth projected beyond the

Fig. 15.



Skull of Anoplotherium.

others, there was no interval between any of the teeth, a character which is now peculiar to man; and the pattern of the molar teeth approximated to and prefigured that of the molar teeth of the existing Ruminants, of which these animals were the precursors and flourished during the early and middle portions of the Tertiary period.

Amongst the diminutive Insectivora a few instances occur, as in the Mole and the Potamogale, in which zoologists are not agreed upon the determination of the canine teeth. These cases are so few that I can scarcely think they will eventually prove exceptions to the general rule, which so universally prevails throughout this extensive order as to the presence of canine teeth. Should it, however, be otherwise, this

will hardly form a sufficient reason to reject the employment of the canine teeth as a distinctive character, or as a means of classification, in the very numerous instances in which they are clearly and easily recognized. In the cases referred to the question can only be decided by a careful examination of the teeth in the embryo so as to ascertain whether the germ of the disputed tooth originates in the *intermaxillary* or in the *maxillary* bone.

Throughout the remaining orders, there is only one exception to the Triidodont form of dentition; this occurs in the Aye-Aye of Madagascar (*Cheiromys Madagascariensis*), an animal belonging to the order Quadrumana. In the Aye-Aye the dentition assumes the type of that which has been described as characterising the Rodentia, and consists of two scalpriform incisors in the upper and lower jaws, separated by a vacant space from four simple molars on each side the upper, and three on each side the lower jaw. This animal is a stumbling-block to the classifier whatever characters are taken, and it has been variously placed by different writers; but is now generally admitted to belong to the Lemurs, these animals themselves constituting an extreme form of the Quadrumana.

In conclusion, I would observe that the proposed classification originated in my endeavours

to ascertain the best means of arranging the specimens in the museum, so as to exhibit not only the characters of the teeth in each species, but also the relation in which these organs stand to the general plan of animal organization.

In every attempt to establish a linear arrangement of the families and orders of the Mammalia, we must expect to meet with exceptional forms that will not accord with our artificial systems, and also with abrupt transitions from one type of life to another, which we are unable to connect by intermediate grades of development, whether the classification is based upon the characters of the brain, the placenta, or the teeth. At the same time it should be remembered that several of these gaps have been filled up by the discovery of fossil forms, which possessed characters that at the present time belong to distinct orders of the Mammalia, and which they served to link together, in the same manner as we have seen the Dinotherium uniting the herbivorous Cetacea to the Proboscidia. How far the further researches of the Palæontologist may lead to the discovery of other extinct animals that shall supply the missing links, it is impossible to say.

The object of every classification should be to embody in a clear and simple manner the actual knowledge which is possessed of the animal kingdom, or of that portion of it with which the classification is concerned. To what

extent this may be considered to be fulfilled by the classification that has now been proposed must be left to the judgment of others. It at least possesses the important qualities of clearness and facility of application. The arrangement of the different orders does not differ materially from what has been previously adopted by other writers. The relation in which the teeth stand to the general organization of the animal is brought more prominently forward, and the classification, although it should not be accepted for the general purposes of the zoologist, would seem to be well adapted for arranging the specimens in a dental museum.

Discussion.

At the conclusion of Mr. Hulme's paper, the President invited a free expression of opinion on the subject that had just been brought under their consideration.

Mr. Vasey, after tendering his thanks to the Curator, said he considered that every member of the society ought to do all in his power to assist him in collecting specimens for their museum. They could not expect to have a large museum, but they might at least succeed in obtaining a good collection of special subjects of the highest interest. Many members had solitary specimens at their own homes. If they would contribute these to the museum, they would greatly benefit the Society and encourage the curator in his exertions. When Professor Owen came among them on a recent occasion, he spoke of three specimens, which he considered rarely to be met with; and he was highly pleased to find the Society had already got them. This fact, Mr. Vasey thought, was at the same time most gratifying and encouraging.

Dr. Murie (Zoological Gardens) said he was very much pleased with the clear manner in which Mr. Hulme had explained his views. But as the President had invited a free expression of opinion, he begged leave to differ in some respects with him. In forming a Dental Museum the gathering together of a large collection of specimens was not of so much importance as a proper arrangement of objects. Dr. Murie then proceeded at some length to state what were his opinions as to the arrangement to be followed, and referring to Mr. Hulme's diagrams pointed out in what points he differed with what had been laid down in the paper just read. The general structure of the room in which the specimens were to be exhibited, the manner in which it was lighted, the form and disposition of the shelves, and the like, were, he thought, matters to which considerable attention ought to be devoted. In conclusion he paid a tribute of praise to the zeal and enthusiasm of Mr. Hulme in his work, and considered that he had done good

service to the society by the way in which he had brought this subject before them.

Mr. Hulme, after thanking Mr. Vasey and Dr. Murie for their remarks, stated that the time was so far advanced that his reply must be very brief. He believed that, in all essential points, Dr. Murie and himself nearly agreed. The principal difference was, that Dr. Murie viewed the subject from a purely scientific point of view, while he had regarded it also in respect to the wants of the dental practitioner, and had felt it was necessary that what related to dental practice should take precedence of the natural history portion of the museum. He must apologize to the members for having detained them so long upon a matter that could not lay claim to be considered as a practical subject; the best excuse he could make was that the paper had arisen out of work which he had endeavoured to do in the museum, and that he knew of no society before which such a proposal as the one he had made for the classification of the placental mammalia by means of the teeth could be brought with greater propriety than the Odontological.

Mr. Harrison (treasurer), read the financial report of the year, which showed that the receipts for the year ending October 31st, 1868, were £370. 13s. 0d., the expenses, £360. 2s. 10d.; the entire assets of the Society down to this date were, cash £276. 9s. 7d., Stock in New 3 per Cents £663. 12s. 2d.; and that the number of subscribers was, resident 89, non-resident 144; in addition to which there were 21 corresponding, and 25 honorary members.

After an hour's space had been allowed for the depositing of votes in the ballot-box, the ballot was closed. The scrutators, after inspecting the votes, announced that the entire list, as recommended by the present Council, had been returned. The President thereupon declared those gentlemen duly elected officers and councillors of the society for the year 1869.

The list was as follows:—

President.—H. J. Barrett, Esq.

Vice-Presidents.—Resident: R. Hepburn, Esq.; Arnold Rogers, Esq.; John B. Fletcher, Esq. Non-resident: S. L.

Rymer, Esq. (Croydon); P. Orphoot, Esq. (Edinburgh); George T. Parkinson, Esq. (Bath).

Treasurer.—W. A. Harrison, Esq.

Librarian.—Alfred Coleman, Esq.

Honorary Secretaries.—Ordinary: Edwin Sercombe, Esq.; Charles James Fox, Esq. For Foreign Correspondence: John Drew, Esq.

Councillors.—Resident: G. Gregson, Esq.; C. Vasey, Esq.: Edwin Saunders, Esq.; A. Hockley, Esq.; J. Walker, Esq.; Isaac Sheffield, Esq.; J. W. Elliott, Esq.; Thomas A. Rogers, Esq.; W. G. Bennett, Esq. Non-resident: R. Ransom, Esq. (St. Leonards); H. Campion, Esq. (Manchester); H. Morley, Esq. (Derby); J. Steele, Esq. (Croydon); J. S. Coles, Esq. (Plymouth).

The PRESIDENT made the following address on resigning the chair:—

GENTLEMEN.—This, I think, terminates the business of the anniversary meeting of the Society, and before retiring from this chair, I will offer a few remarks on the present state and future prospects of the Society. In February last, on undertaking the duties of president, I promised that my best endeavours should be exercised in advancing its interests and extending its influence, and I trust in this I have not been altogether unsuccessful.

The first subject to which I wish to draw your attention is that of finance. I am aware of the generally uninteresting nature of figures; but as no Society can progress without ample means at its command, I cannot forbear to draw your attention to the good balance our Treasurer has this evening announced to our credit.

Judging by the report received from our treasurer, it appears to me fortunate that we have secured so successful an administrator of our worldly goods. It is difficult for me to express in sufficiently strong words my thanks to him for the care and attention he bestows on our interests and the judicious economy he at all times advocates.

You will perceive that the small balance of income over expenditure is attributable to the sum of £207. 15s. 1d., due

on the cost of the publication of the last volume of our transactions, during the previous year being made chargeable on the income of the past financial year, the whole amount chargeable for expenses connected with the Society for the past year, being the moderate sum of £152. 9s. 1d.

Our treasurer has likewise informed you of the present state of the Society with regard to its gains and losses during the past year. I confess it would be more gratifying to find a larger accession to our ranks from the members of our profession; however, on this point I look forward to the future with much confidence.—It has been our misfortune to lose during the past year three members by death. I am sure we all greatly deplore their untimely removal, severed as they have been from their families and friends, probably at the most valuable period of their lives. They are Mr. Faro, of Barnstaple, non-resident; Mr. Josiah Saunders and Mr. Winterbottom, Senr., resident members. Mr. Saunders joined our ranks at the first formation of the Society and has served on our Council. The latter joined us at a later period, was a very warm supporter of the Society and was serving on our Council at the period of his death; he was one to whom we might have looked forward to fill at no distant date some of the higher offices of the Society.

Our Librarian informs us that several volumes of value and interest have been added, either by presentation or purchase, to our library, and I hope before long to see it, by judicious additions to its contents, assume an importance which this Society may be justly proud of. But it is with very great regret on my part, and I know also on yours, that we are to lose the valuable services of our late librarian, Mr. Fletcher. I have not language sufficient to express to you the great services rendered by him to the Society during the many years he has occupied that position; I can, however, assure him that we fully recognize and appreciate these services. I feel that a special vote of thanks is justly due to him from this Society for the skilful and zealous manner in which he has fulfilled his duties.

Fortunately we have had the happiness to secure Mr. Coleman as his successor, a gentleman whose ability and diligence

eminently qualify him for the post of honour just vacated, and I feel assured that if our regret at the loss of Mr. Fletcher can in any way be assuaged, it will be by the knowledge that we have for his successor the gentleman we have just elected, Mr. Coleman.

You will recollect, gentlemen, that our former president, Mr. Ibbetson, in January last, on retiring from this chair, most liberally placed at the disposal of the Council a gold medal of the value of twenty guineas, to be competed for on any subject which the Council might in its judgment determine. The Council selected "The Histological Structure of the Human Teeth," and now offers the prize for competition to the whole scientific world. May I express a hope that the successful competitor may be found in our own ranks?

All the officers of the Society are charged, more or less, with labour and responsibility; but perhaps the secretaries of the Society claim more of your sympathy and indulgence than any others. From their labours they seldom rest: at each meeting of the Council, at each meeting of the Society, they have to record the whole business transacted, and put it in such a form as to receive our approval and confirmation. Apart from the meetings of the Society, they have to conduct the business and correspondence—sometimes of a complicated and delicate nature—and on their good sense and judgment a great deal depends; if, by any forgetfulness or undue pressure of business of their own or ours they happen to fail, they render themselves liable to censure. We are about to lose the services of our late hon. secretary, Mr. Drew, who for a period of three years has diligently and intelligently laboured for the honour and welfare of the Society. We have secured as his successor Mr. Sercombe, who has been an active member of the Society from its foundation, and I believe we shall have in him the right man in the right place.

With respect to Mr. Fox, I can with justice testify to his exertions on our behalf. For myself personally I have to thank him most kindly for the attentive consideration he has always given to my wishes; being still our secretary, and having yet to win his spurs, I will leave it to my successor to eulogise his labours when they are completed. To our late

foreign hon. secretary, Mr. Charles Rogers, I beg to offer my kind thanks for the services he has rendered to the Society during his past official career.

It has been our misfortune, during the past year, to have had to erase from our list, as defaulters, nine of our members; and, with respect to this, I think it desirable I should explain the cause of this proceeding.

A most unfortunate idea exists in the minds of some, that by the non-payment of their annual subscription they cease to be members of the Society, and that no formal resignation on their part is necessary. If the laws of this Society were exceptional, there might be some excuse for this ignorance; but I have never heard, nor do I believe, that in any other society there is any difference in this particular law to our own—viz.: "That any member may withdraw on paying any contribution that may be due from him and signifying his intention in writing to the secretary." Of these nine members, whose names have been erased by our Council, each has been officially acquainted—and, I believe, more than once—by the secretary, of his being in arrear of payment of his annual subscription. I also know that our treasurer has in some, I believe in all cases, privately and unofficially, in a most kind spirit, written to inform them of the requirements of our laws and the consequence of not conforming to them. I am sorry to add, these communications were replied to in a very unsatisfactory spirit; therefore there remained no alternative on the part of the Council but to erase their names, as defaulters, in conformity with our laws. No doubt you are aware that, being neither a corporate or chartered body, we have no means of enforcing payment of these arrears. We are in a worse position, in this respect, than Trades' Unions—we have not even the privilege of rattening. No, gentlemen; for the advantageous existence of this Society, we are governed by a code of laws of our own creation, imposing on us a moral obligation to fulfil that which we have undertaken to respect, and which, I am glad to say, in most cases has been found sufficient; so I trust that any future Council of this Society will act in a similar spirit, and erase from our list the names of those who so far forget their obligations to us.

Our honorary secretary has made you acquainted with the list of benefactors of the past year: to these gentlemen we are indebted alike for their presentations and the interest taken by them in the welfare of the Society.

Our museum, being now under the able and skilful management of our curator, Mr. Hulme, I do hope to live to see the day when it will take an important position amongst the many valuable collections of a like nature in this metropolis.

The papers read before the Society claim our next attention. With the subjects and general character of the papers during the past year I think we have great reason to feel satisfied. In February we had an interesting paper by Mr. Oliver Chalk, "On the History of a Case of Scrofulous Necrosis of the Lower Jaw," &c., which produced a most animated discussion.

We were fortunate enough to obtain in March a paper from the pen of Mr. Clover, on a subject which, by his numerous experiments and great experience, he has made himself master of. I refer to the administration of chloroform in dental operations. The paper was thoroughly practical, and imparted very valuable information as to the safest means of dealing with this extensively-used anæsthetic.

The paper read in May by our treasurer, Mr. Harrison, detailed to us the successful operations he had performed in conjunction with Mr. James Lane, on the upper and lower maxillæ and mouth of a man who had been for many years a very great sufferer. You are in full possession of all its important features, and I feel I can say little that will either add to its value, or raise it in your estimation. Although a subject not exactly coming within the range of our particular branch of practice, yet from its being so nearly allied, it was most acceptable to us.

In June Mr. Christopher Heath read an able paper "On Tumours of the Jaw."

Mr. Heath's accurate and extensive knowledge of the surgery of this region makes his paper a valuable contribution to our year's "Transactions."

The paper by Mr. Lawrie in November, "On Amalgam and Plastic Fillings," touched a subject of great interest, as was evidenced by the earnest discussion that followed it. I ven-

tured at the time to express my belief that Mr. Lawrie was misunderstood—that he never contemplated placing gold and amalgam fillings upon an equality, or giving undue encouragement to the use of amalgam; his object was, admitting the two methods to be recognized and servicable, by discussion to extract the opinions of those in the habit of using amalgam, as to the best method of preparing and applying the amalgam, the cases in which it would probably prove the best material for stopping, and further to bring out the respective merits of the various amalgams in use. Speaking individually, and knowing that amalgam filling is constantly and successfully used, I would avoid, in discussing this particular filling, wandering into that region of art where gold alone appears to reign supreme. I would much prefer discussing the two methods separately, allowing each to stand on its own merit, and awarding to each its real value. The subject of amalgam filling I do not consider has ever been sufficiently discussed, and for this I feel sorry; as, call it plastering, or by what term you please, from experience I am willing to testify, under certain conditions, and provided sufficient care and skill be exercised in its applications, that it is a useful and durable filling.

The last, though certainly not the least important, paper of the year is the one you have just heard read by our curator, Mr. Hulme. It treats on a subject which I consider well worthy of your serious consideration. To possess a museum for reference would be to us an immense advantage. There are few amongst us who in the course of our daily work do not occasionally meet with something unusual, some peculiarity appertaining to our speciality. Each by itself can be of little value to the possessor, but, by collecting, classifying and arranging them under the able management of our curator, they will form in due time a most valuable and available means of instruction. Let me ask you, then, to consider this matter attentively, and forward when opportunity offers anything of interest that may cross your path.

At our meeting in April, I had the pleasure of drawing your attention to a comparatively new anæsthetic, Nitrous Oxide; for, notwithstanding the statement of Sir Humphry Davy, at the commencement of the present century, that it

possessed the quality of an anæsthetic, its power to alleviate suffering remained unemployed until the year 1844, when Dr. Horace Wells, a dentist in the United States, first introduced it as a practical anæsthetic. Dr. Wells laboured in vain for more than three years to overcome the prejudices of the medical profession to the use of this gas; but with his death in 1848, to use an Americanism, it was again tabled until 1863, when Dr. Gardiner Q. Colton, a fellow-experimentalist with Wells, reintroduced it in America, and this time with success, for he informs us that in the five years following, he administered it successfully in about 27,000 operations.

Dr. T. W. Evans having become acquainted with the success of Dr. Colton in the use of this gas, drew the attention of his brother practitioners in this country to it; and this introduces us to a very interesting epoch in the annals of this Society. Had it not been for the ready and available organization and influence of this Society, and the sympathy existing between it and the Dental Hospital of London, it would in all probability have remained unused in this country at the present day; in fact, from the chair of a kindred society, we were said to be "labouring under childish excitement; that the gas was one of the best known, least wonderful, and most dangerous of all substances that had been applied for the production of general anæsthesia." These were strong words, but no doubt well intentioned. But we were not so childish as represented; we had not taken a leap in the dark; we had taken the trouble to inform ourselves, and we saw looming in the distance an available and practical instrument for our purpose; and I ask you if in this we have been either deceived or disappointed? In nine months we have succeeded in greatly reducing prejudice, and establishing its character as a valuable anæsthetic. And as to "being the best known," are physiologists of the present day —are our greatest chemists—are those who have been its largest experimentalists, agreed as to its true physiological action? There can be little doubt, however, from the great amount of talent at present engaged in this investigation, all this uncertainty will be soon removed. "The most dangerous and least wonderful,"—is this opinion confirmed? Not unless we are to

disbelieve the statistics furnished by Dr. Colton, that, in the United States, since 1863, upwards of 27,000 cases have been treated without either fatal or injurious results; and also that, in this country, since its first introduction, nine months since, 1,400 reliable and tabulated cases have been treated with a like result. I ask you, can chloroform afford you so favourable a result? These opinions, so hastily given, were no doubt in consequence of the limited knowledge existing, and the little advantage taken of investigating, notwithstanding the hints offered by Davy, its anæsthetic properties. No, gentlemen; this assumed knowledge has proved partly a myth, if we are to judge by results. Until 1844 this one great quality remained untouched. Had equal zeal been exercised in developing its useful, as in promoting its frivolous employment, the merciful relief produced by anæsthesia would have been anticipated by nearly half a century.

But, gentlemen, there still remains this fact, and to its honour let it be recorded, that the Odontological Society was foremost in laying aside prejudice, and, in conjunction with the Dental Hospital of London investigating this, as it has proved, most valuable and available anæsthetic agent; and provided the administration of it falls only into the hands of those sufficiently experienced in its application, and not into the hands of quacks and unprincipled persons, I do not think we shall have any desire to repudiate our connection with its introduction into this country.

Perhaps what we have most to dread is, that its hitherto great success, the ease of its application, the great facility about to be afforded in obtaining the apparatus for its manufacture, and the instruments for its administration, may entice many to adopt it, without first acquiring sufficient knowledge of its various qualities. For it must be remembered that, like other anæsthetics, it has its dangers, and is not to be trifled with, and sadly should we deplore if, through ignorance and inexperience, such a valuable agent should be exposed to danger and distrust.

Our meeting in December was, as you must well remember, devoted to the reception of the Report of the united Committee of this Society and the Dental Hospital on the use of

Nitrous Oxide, and I believe it will be long before you will be called on to take part in a subject of equal interest or importance. As the proceedings have been published *in extenso*, I need not detain you by any further allusion to it.

I now approach a subject which I regard as the most important that has been brought before you touching the welfare and progress of the Society. I refer to the new issue of our "Transactions." You are now, for the first time since your existence as a Society, in possession of an official publication, in which you will receive, periodically, all matters of importance connected with the Society: this has, I consider, for some time been urgently needed.

In the early organization of this Society, owing to the wide difference of opinion existing between the various sections of the profession, it was absolutely necessary that those members of the profession who were united in one common idea should have the means of communicating with the profession at large. Hence the introduction of the *British Journal of Dental Science*. This publication, although recognized by, was at no period the property of, this Society: still it had a sort of semi-official existence; and at that early period was the only available channel wherein to publish our proceedings.

After a period, the proprietorship of this journal passed into other hands, and unfortunately, owing to the illness of the editor, its publication became for a season very irregular, so that it did not suit the interests of the Society to longer employ it as a channel for publishing their monthly proceedings.

It occurred to myself and others that the time had arrived for considering the whole subject in connection with our publication, and from this inquiry originated the present issue of the new series, which, I think you will agree with me, reflects infinite credit on the honorary members of our Publishing Committee.

The whole body of members under this new régime will receive regularly a full and authentic account of everything of interest that takes place at the meetings of the Society. It also places all the members of the Society in direct and frequent communication with it. I have a strong impression that this will have a most beneficial influence in stimulating

members to exertion on its behalf, and largely add to our numbers, especially among the provincial members of our profession, who cannot frequently attend our monthly gatherings. The present form of publication, embracing, as it does the paper read, the casual communications, and the discussion, will render unnecessary the former method of publishing our Transactions. Those Transactions,—valuable and beautiful as they were,—in consequence of the unavoidable delay in collecting a sufficient number of subjects to form a volume, became necessarily somewhat stale, and formed no great incentive to authors to furnish us with papers. I trust this will now be entirely removed; also those who hitherto thought they did not receive sufficient in return for their subscription will rest contented. Well, gentlemen, your executive having performed their part, now look forward to you to lend your aid and energy to promote the success of our new publication.

I think, gentlemen, I have laid before you a complete statement of the present position of the Society in each of its several departments—financial, social, and scientific—and I trust you will not consider the past year as wanting in progress. It is not, I assure you, without a pang of regret, in retiring from this chair this evening, that I separate myself from many with whom it has been my greatest pleasure, on different occasions, to serve in your executive. To the Council I take the present opportunity of expressing the deep obligation I am under for their individual and united assistance, and the kind consideration they have on all occasions given to my suggestions, in return for which I now offer them my special and warmest thanks.

And to you, the members of the Society collectively, I tender my kindest thanks for the generous support you have afforded me on all occasions, and I beg to assure you that in all I have done either in my private or public capacity, I have had but one object in view, the advancement of the interest of our common Society.

Mr. Thomas Rogers moved a vote of thanks to their esteemed President for the manner in which he had filled the chair during the past twelve months. Occasions had arisen, and especially that of the last meeting, when it was highly im-

portant that the dignity of the Society should be upheld by an efficient chairman. The President had ably sustained that dignity. He had, moreover, acted during the whole period in full accordance with the Council. He therefore moved that the best thanks of the Society should be given to their Chairman.

The motion was passed with acclamation.

The PRESIDENT, in acknowledging the vote, said: The kind manner in which you have received the proposition which my friend Mr. Thomas Rogers has offered to you, and which you have so cordially and unanimously accepted, increases largely my debt of obligation to you. I trust in my retirement I shall never forget your kindness nor the interests and welfare of this Society. Gentlemen, I beg again most sincerely to thank you for your kind expressions.

The meeting then adjourned.

GENERAL MONTHLY MEETING,

Monday, February 1st, 1869.

HENRY JOHN BARRETT, Esq., President, in the Chair.

The Minutes of the last Meeting were read and approved.

The following gentleman was elected a member of the Society :—

Mr. Francis George Bridgman, 12, Queen Anne Street, Cavendish Square.

The following Gentleman was proposed for the membership of the Society :—

Mr. Bevan Fox, Exeter.

Mr. F. I. Vanderpant signed the obligation-book, and was admitted a member of the Society.

The President read the following Address :—

Gentlemen,—I thank you most cordially for the honourable position you have been pleased to confer upon me ; yet I cannot hide from myself, nor will I conceal from you, the feeling uppermost in my mind, that others more competent to perform the duties of President might easily have been found in this Society. Your President, I am well aware, should be one who has not only already given much time and service in the interests of this Society, but who can continue to give his full energies to press forward the advancing steps of this flourishing association ; who, by an example of unwearied diligence and fertile resource, may stimulate the productive elements which surround him. But when I find myself assisted by officers so efficient as those you have elected, and a Council so devoted to your interests, the arduous and

responsible duties of your President are materially lessened, and I have only to turn to you, gentlemen, who are the real supporters of this Society, to assist in the good work of progress.

There are many of our members who have already given us valuable papers on subjects of great interest, which have not only afforded instruction when read before this Society and discussed, but have served as guiding-stars to those who, living at a distance, would otherwise fail to participate in these advantages. But have we yet exhausted the field of our labours?—have we even cultivated the soil sufficiently to produce that harvest of knowledge which this Society is capable of yielding? I think not; and, as President, I earnestly call on you, especially upon the younger members whose time is less absorbed by the exigencies of practice, to devote your leisure to the investigation even of some one point in reference to dental disease and treatment. A writer has observed that "that man occupies the highest pinnacle in our profession, and marches in the *first rank*, who is the most intimately acquainted with morbid action, its causes, its history, the tissue-changes resulting from it, and its treatment."

When, by reading, you have obtained a knowledge of what has already been demonstrated, and can, by carefully conducted experiments or accurately reported cases, confirm these views,—or if, by a higher course of study and analytical inquiry, you may, by the aid of new facts, arrive at original views,—this consummation, so devoutly to be wished, will be hailed by this Society with enthusiasm, and the donor of such communications justly considered a benefactor.

To those whose knowledge has been gained from observation and long experience by the side of the operating-chair I would venture to say a few words. You, gentlemen, now possess a knowledge which has not been acquired from books, which few books indeed can teach, but which is most valuable—invaluable, indeed, to the tyro in our profession. I do not refer to the quick perception of disease—that rapid but correct glance which enables the operator at once to attack the cause of the evil; nor do I speak of that *tactus eruditus*, that mind at the

fingers' ends, without which no man can be even a moderate operator; but I speak of the knowledge which leads you, either in the case of irregular dentition or in the more prolonged treatment of extensive caries of the teeth, mentally to seize upon those points in the treament which must be enforced in order to insure a successful result, and, in spite of sympathizing parents or over-sensitive patients, firmly and honestly to carry them out.

I believe that this confident knowledge may be imparted by frequent discussions in this room on practical subjects of every-day experiences, each relating his failures as well as his successes, and relating all accurately and impartially, without the varnish which may exalt the speaker or give colour to any pet theory; and, whenever practicable, the models, or the actual case itself, should be brought before the Society. Permit me to offer but one example—and, I would ask, who amongst us would not be benefited by listening to the recorded case of a neglected mouth, whilst examining the models taken before and after treatment, showing where teeth had been extracted, hearing why this was necessary, and what instruments were used for the purpose? Even more might perhaps be gained by an exact and minute report of the various teeth filled, form of the different cavities, instruments used in all stages of the operation, treatment required before filling, how gold was packed, or why amalgam preferred. These, with an almost infinite variety of incidents, from the operator's commonplace book, which would be out of my province here even to refer to, would, in my humble opinion, tend to carry out very effectually one, at least, of the important objects for which this Society was instituted—namely, the diffusion of knowledge in dental surgery.

Perhaps I may here be permitted to offer my warm expression of thanks for the discriminating and judicious selection of a subject made by our late President, Mr. Ibbetson, who, actuated by a warm interest in our profession, has recently offered a prize for the best original essay on "The Histological Structure of the Human Teeth." The knowledge of the minute anatomy of healthy tissue lies at the very basis of our treatment of the diseased structure, and may even open up a

method of inquiry which will lead to the discovery whence these morbid changes arise.

Gentlemen, we cannot too highly value the advantages which are offered by this Society to those who desire the fame which authorship affords. A mere glance at a volume of our "Transactions" would suffice to satisfy the most punctilious that his paper and his diagrams will receive justice from the hands of the publishing committee, and, what is perhaps of some importance, his paper will be printed and circulated without one fraction of cost to the writer.

May I allude for one moment to the advantages offered by our Dental Hospital? Are not these incalculable?—not only affording opportunities for perfecting the student in his mechanical knowledge and skill as an operator, but presenting readily to his notice the means for any extent of pathological study he may desire.

Are we availing ourselves of these opportunities with that eager determination which will place us in the foremost rank of scientific inquirers?

Gentlemen, we all have the interest of this Society at heart; but to feel it, is not enough; we must labour for this result, and not leave our success to supineness or lukewarm indifference, always remembering that our future position and progress as a body depend upon our individual efforts.

The PRESIDENT announced the receipt of a bottle of compressed nitrous oxide gas from Mr. Coxeter. The weight of it was twenty pounds.

Mr. KING, of Newark, presented a model and two incisor temporary teeth with a supernumerary tooth united to each laterally.

Mr. VASEY mentioned a late case in which he had found two incisive teeth and two supernumeraries united.

Mr. RYMER said that he had had, that very day, a case where the central and lateral were united. The patient was a girl seven years old. The union was complete.—In answer to a question, Mr. Rymer said that the permanent were rising behind; there was no other peculiarity.

Mr. CHARLES JAMES FOX said there was a child at the

Dental Hospital that morning that was born with a lower central incisor quite perfect: but the tooth soon crumbled away, and he had to remove the tooth, which had become necrosed.

The PRESIDENT said he witnessed a case, some years ago, of a child that had the two lower incisive teeth when born. They had to be drawn, to allow the child to take the nipple without injuring it.

MR. SEWILL wished to ask a question, which, he had no doubt, some of the committee, who were investigating the action of nitrous oxide, would see the importance of answering. He wished to know if, as the result of their experiments thus far, they had determined whether engorgement of the lungs with blood took place during the administration of the gas; and, if so, whether the engorgement was sufficient to be a source of danger in diseased conditions of the lungs—for example, in phthisis? He was prompted to ask the question, having seen, in a medical paper, a contribution from one of the committee, describing symptoms which had appeared in a phthisical patient after the inhalation of the gas.

Mr. COLEMAN said that, in the experiments made by the Committee upon the lower animals, the lungs did not appear to be unduly engorged with blood, either during the time of the administration of the gas or after the animal had died under its influence. The lungs certainly appeared of a darker colour; but this was due to the darker colour of the blood they contained. In all cases both sides of the heart were distended with blood, which proved that there could be no impediment to the pulmonary circulation. With regard to the danger of administering this agent to persons suffering from diseases of the lungs, it had been given to several patients suffering from phthisis, without any unpleasant symptoms presenting themselves. He had administered it himself to one patient in a very advanced stage of that disease, and the patient did extremely well. Of course, unusual care and precautions had been adopted in its exhibition in those cases.

Mr. SERCOMBE mentioned two cases that had come under his notice since the report was published by the Society. One was that of a young man 21 years of age, a confirmed epileptic. He was curious to know the effects which the nitrous oxide

would have upon this patient, and he invited Dr. Burdon-Sanderson to be present during the administration. The patient took the nitrous oxide well, and became insensible in 70 seconds. The return of consciousness was somewhat slower than usual—viz., 2 minutes 30 seconds; but the young man exhibited no convulsive movements. The other case showed that a person might inhale a large quantity of the nitrous oxide, and remain a longer time under its influence without any hurtful effects than was supposed at first possible. The patient in this case was a young lady. She was kept under the gas for one hour, never being properly sensible during the whole of that time. The quantity inhaled by her amounted to 50 gallons. He caused the lady to rest herself a few hours at his house, in order that he might watch her. Her recovery was most satisfactory, and she had since felt no evil results.

Mr. Cattlin asked at what intervals air was administered in this case.

Mr. Sercombe said he would furnish them with all the details of the case at their next meeting. He made a practice of noting down the particulars of each case, the number of teeth extracted, and the name of the medical man present, together with the time of inhalation and recovery. Since he had not his book with him, he would answer, generally, that the nitrous oxide was administered six consecutive times in that case, the patient never being fully sensible during the whole time.

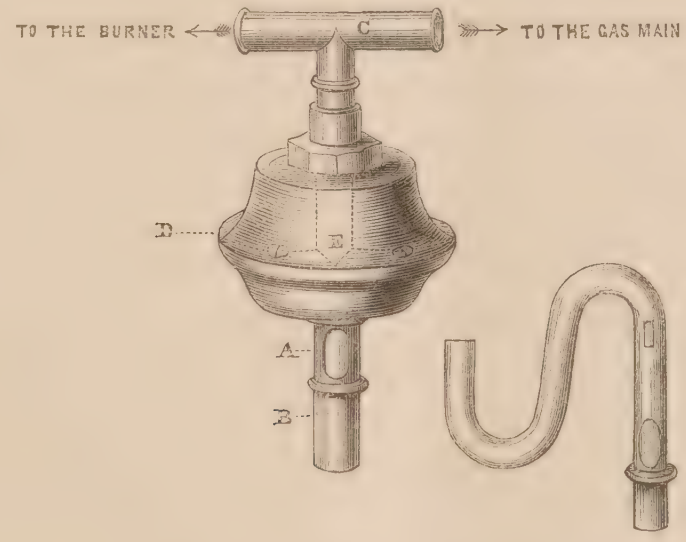
Mr. Cattlin said the experiments he had made on animals were quite corroborated by the experiments mentioned by Mr. Coleman, that no congestion of the lungs takes place. He had also administered the anæsthetic in confirmed cases of phthisis, and he had never yet discovered any evil to follow.

Mr. Coleman mentioned a case in which a patient had had 26 teeth removed during thirteen administrations of nitrous oxide at five visits. It was a case in which the patient had been considered an unfit subject for chloroform.

Mr. Vasey recommended a perusal of Sir Humphry Davy's work on nitrous oxide. It answered by anticipation many of the questions put from time to time at this Society. He

believed it was still to be obtained, and he would venture to recommend it to the attention of members.*

Mr. Charles James Fox said he had to introduce to their notice one of the most ingeniously contrived regulators that he had ever seen for controlling the heat in the manufacture of nitrous oxide. He had requested Mr. Ash, whose invention it was, to send it for exhibition that evening. It was well known that he, Mr. Fox, was a warm advocate for the regulator used for so many years by Dr. Colton, and known as Sprague's regulator, and he continued to prefer it as more simple and impossible to get out of order than any yet contrived, the agent used for shutting off the coal gas being simply water, whereas in this of Mr. Ash's the agent was india-rubber, which he feared was liable to be affected by the emanations from the boiling nitrate of ammonia. Nevertheless, he could not but confess that for ingenuity and compactness Mr. Ash's regulator surpassed any he had yet seen, and he hoped it would be found that the objections he had thought it right to make would prove groundless. Mr. Fox then described the diagrams as follows :—



The coal gas is admitted by the tube C, which flows into the regulator at the end of the tube E; an india-rubber dia-

* "The Collected Works of Sir Humphry Davy, Bart." Edited by his Brother, vol. iii. London : Smith, Elder, & Co., Cornhill. 1839.

phragm, D, which is forced up against the end of the tube E, by the pressure of the nitrous oxide passing up the tube B, shutting off the coal gas.

A is an india-rubber valve to supply air to the flask and wash-bottles at the conclusion of the gas-making, in order to prevent the flow of the liquids from one bottle to another, occasioned by the vacuum caused by the sudden cessation of the heat. To prevent the posssibility of the nitrous oxide being impregnated, in any degree, with the coal gas from any flaw in the india-rubber diaphragm, some of the regulators are made with a siphon tube to contain water. The nitrous oxide, in that case, pressing up the columns of water, forces it against the diaphragm, and so shuts off, more or less, the gas from the burner.

Mr. Sercombe said they must all have felt, especially during the late foggy weather, the necessity of having a good artificial light, by which they could operate on dark days. He wished to exhibit a new lamp manufactured by Mr. Orchard, of Kensington,—an oxycalcium lamp, which throws a jet of light like sunlight into the mouth, and enables one to stop teeth in all parts of the mouth. He had worked four hours with this lamp in one day during the late dull weather. The only inconvenience experienced was when the patient changed position; but as the pencil of light was large enough to fill the whole mouth, the change of position must be considerable to cause the inconvenience. There is some amount of heat experienced by the patient in the part illuminated, but it is rather agreeable than otherwise.

Mr. Ramsay had found it convenient to have a good general light in the room when he used a strong light in the mouth.

Mr. Thomas Rogers said he had used an ordinary bull's-eye lamp, and found it very serviceable.

The President then called upon Mr. Sewill to read his paper.

The Comparative Value of the Materials used in taking Impressions of the Mouth. By H. E. Sewill, Esq., M.R.C.S., L.D.S., &c.

Mr. President and Gentlemen,—

When asked, a few days ago, to read a paper at this meeting, I was, from various circumstances, induced to comply with the request. In the first place, the gentleman who had previously promised a paper had been unexpectedly compelled to withdraw, and a danger appeared that at our first meeting under our new president we might find ourselves without a due amount of business to transact. I felt that at least I might avert this danger, and that, however crude and imperfect my contribution might be, it would be received with that generous spirit which is invariably displayed by this Society when a willing attempt is made to serve it. The subject and the mode in which it should be brought forward having been both agreed upon, any remaining hesitation was overcome. It was decided that I should open a discussion upon the comparative values of the materials used in taking impressions of the

mouth; that my paper should not be put forward as one, upon its own merits, worthy of the principal place in the business of the evening, but that my sole endeavour should be to excite a useful debate. I had great confidence in predicting that a much more valuable contribution to our Transactions would be formed by the report of such a debate, than by a more elaborate and exhaustive paper from me.

The subject I have chosen recommends itself to us on several grounds. Its importance is manifest, and to dwell upon this before an audience of dentists would be absurd. Taking an impression of the mouth is the first step in almost every process of mechanical dentistry, and upon its success depends every subsequent operation. Further, it is obvious, *cæteris paribus*, that apparatus will be most perfect which is constructed upon the most perfect model. Another, and not the least recommendation, possessed by this subject is that each member of the Society is familiar with it, and therefore competent, without preparation, to discuss it. When a topic of purely scientific interest is broached, it very often happens that even the most learned find some difficulty in entering upon its discussion. New theories in science can be but seldom fairly grasped whilst rapidly thrown out in the reading of a paper. There is naturally a hesitation about the expression of hastily-formed opinions, aud thus in

such cases the debate is commonly cut short. This state of things has been experienced elsewhere; and at one society it has been proposed as a remedy that, when desirable, an abstract of the paper shall be sent to each member some time prior to the meeting, so that he may come prepared to support or combat the views advanced. This appears to me a valuable practical suggestion, and I venture here to bring it forward.

The subject before us to-night is, as I have remarked, one with which we are all conversant; but when I add that I have no new theories to put forth, no new materials to introduce, and no modes of practice to describe which are entirely unknown to even a few members of the Society, the question will probably suggest itself—why, then, choose so trite and apparently unprofitable a topic? The answer to this question is, I think, not difficult. First, it will be found that various materials are employed in taking impressions, and that considerable difference of opinion prevails as to those which are absolutely necessary in practice, and as to the most effectual modes of manipulating them. We cannot advance as a body until each individual is on a scientific equality with the rest; and it is easier for individuals to advance, both in investigation and in practice, when acquainted with the practice of the majority, and with the principles upon which their practice is based. Then, again, although it

is probable that in the minute details of mechanical manipulation some difference will always prevail, we should undoubtedly all be agreed as to the broader lines of practice. How are true principles to become established, excepting by the examination of the views of every competent observer? Moreover, in every branch of practice it is found that there accumulates, from time to time, a valuable amount of individual experience which would be lost to the bulk of the profession were it not eliminated in societies such as ours. The object, then, of conferences such as I attempt to initiate to-night is to elicit new facts as they accumulate, and to determine which of opposing views are correct. Our proceedings are now permanently recorded; and if my experiment succeed to-night, and if these discussions become periodical, a valuable literature of mechanical dentistry will soon be formed. Formerly such discussions would have been almost entirely lost. Now, however, those present at the meeting have the opportunity subsequently of studying the subject at leisure, and those at a distance are placed under circumstances almost as favourable as though they were actually present at the debate. All this testifies to the wisdom of the step taken by the council in publishing a full monthly report of our proceedings.

We are to discuss the comparative value of the materials used in taking impressions. In

order to arrive at a conclusion, we must be acquainted with every substance which is usefully employed for the purpose; and in order that our judgment may be fairly exercised, we must know what are the most effectual modes of preparing each material, of manipulating them in the mouth, and of obtaining from them the most perfect plaster cast. It may be found that no material is universally applicable, and that each class of cases has a material specially adapted to its requirements. Not the least important point that we have to determine is to assign to each substance the peculiar advantage which it possesses over others. I trust that each member will furnish us with any item connected with either of these points, and that each will advocate any mode of practice which he considers not generally known or not properly appreciated.

Bees' wax is the material which has been longest in use, and which is, I believe, more extensively employed than any other. Its preparation and mode of use are so well known that it is unnecessary to recapitulate them. There are, however, several points well worthy of being discussed, and which it would be advantageous to settle definitely. Thus, should the wax be softened by dry or by wet heat? What is the degree of softness in which it is most efficiently applied? Should the impression be withdrawn speedily, or should it be allowed to remain until

the wax has arrived at the hardest condition which the temperature of the mouth will allow it to assume? Is it good practice to oil the surface? In brief, to use two terms which will be understood by all present, what means are most effectual in preventing "sucking" and "dragging." So far as I can learn, those who use wax do not employ any apparatus beyond the ordinary tray.

As to the cases in which it is employed, those who use it appear to apply it universally. On this point I may at once express my opinion, which is far from being an isolated one, that it is practically impossible, in any number of cases, to obtain a perfect impression of the mouth in wax; and as this result can be nearly approached by some materials, and can be absolutely reached by others, that wax should not be employed in taking impressions, excepting for preliminary models, or for some other subordinate purposes. Whilst expressing this conviction, which I shall attempt further on to vindicate, I must state that the opposite view is taken by some whose opinions we will all feel inclined to respect. I can only beg that they will let us hear to-night all their arguments; and that they will, if possible, justify their belief that impressions in wax are sufficient for all practical purposes.

Gutta-percha has been known for a considerable period as a material for taking impressions. The earliest account of its use for this purpose is, I

think, to be found in a paper by Mr. Sercombe in the second volume of our Transactions. Gutta percha, when first introduced, was extensively employed; but I believe its use now has been to a great extent abandoned. The kind in use was the pink preparation, sold at the depôts. A mass was softened in hot water, and applied in an ordinary wax tray. It was found to take a considerable time in hardening, and to shrink in the process. If removed before perfectly hard, its elasticity was so persistent that depressions in the mould, such as would represent the rugæ of the mouth, became partially obliterated. There occurred a uniform shrinking of the whole impression. The models obtained in this way had the appearance of being very perfect. There was no "sucking" and no "dragging," and the undercut portions of the teeth were clearly shown. These appearances were, however, deceptive, and a true portrait of the mouth was not presented.

If, however, the proper kind of gutta-percha be used, and if a little art be shown in its manipulation, I think it will be found that this somewhat despised material is really a very useful adjunct in taking impressions. The best kind for the purpose is the common unprepared black variety, sold in the shops. It softens more rapidly, and more completely; it remains soft at a lower temperature; and it presents a blander and smoother surface than the pink preparation.

Then as to the mode of employing it. A special tray must, in each case, be constructed. These special trays are made in this manner. A wax impression is taken, from that a plaster cast, and from the plaster a metal cast is taken in the usual manner. A piece of zinc plate is then struck up to cover the surfaces of which an impression is required, a small interval being left between the plate and the model for the gutta-percha or other material. The inner surface of the tray may be roughly scored with the graver. The model and tray which I send round will illustrate and make clear this simple matter better than any description. It will be observed that where undercuts exist, the plate is left narrow, so that it may be readily removed from the mouth. The objects of a special tray are to facilitate the insertion of the impression and its removal from the mouth, and to enable the operation to be performed with a minimum quantity of material. Such a tray, then, being prepared, is loaded with softened gutta-percha, introduced into the mouth, and pressed home in the usual way. The gutta-percha takes about ten minutes to harden. During this time pressure should be kept up, and this is easily accomplished by the patient who bites firmly upon the tray. A piece of wood may be put across, if necessary, to equalize the pressure, and to prevent the tray from tilting. In removing such an impression, there is no diffi-

culty. The thin layer passing into the undercuts of the teeth yields during the withdrawal, but springs again into its exact position. These models from gutta-percha which I send round will show how perfectly all the features of the mouth are displayed. In some of these cases with teeth standing at divergent angles, and with many deep undercuts, a soft material would come away full of "drags," and a hard material would be immovably locked. With gutta-percha these difficulties are removed, and, carefully manipulated in the manner I have described, I believe that the amount of shrinking is so slight as to be insignificant, and that a very perfect model indeed may be obtained from it. This material can be used in every class of case; but those to which it is more particularly suited will be manifest from the remarks which I have already made.

I now pass on to speak of the material known as Stent's Composition. With its nature and mode of use every member of the Society is, I have no doubt, acquainted. It may be softened in hot water. Perhaps a better way is to lay a cake of it on a toasting-fork, and to warm it over a clear fire, occasionally kneading it with the fingers until the desired degree of softness is reached. It may be used in an ordinary tray. It should be allowed to remain in the mouth until hard, excepting in cases where there is a danger of its becoming immovably fixed. In order to

overcome this danger, and also prevent dragging, special trays may in some cases be employed.

Stent's composition does not contract in hardening. If allowed to remain until sufficiently hard, it does not collapse, or, as we call it, become "sucked" in removal. In favourable cases, therefore, the result is very satisfactory, and a model of the mouth is obtained which is thoroughly to be relied upon. It will be seen that this composition may be favourably compared with wax. "Sucking" is prevented, and the danger of dragging is lessened. The composition will also bear comparison with gutta-percha; for while with the latter material "dragging" and "sucking" are both done away with, these good results are to some extent neutralized by the contraction, which, although almost imperceptible, is stated by its opponents to affect it, however skilfully employed. I send round some models of cases with teeth standing, and also of edentulous cases taken from impressions in Stent's composition.

I now come to plaster of Paris. Of this the finest and freshest kind is alone suitable. That obtained at Robson's, Mount Pleasant, Gray's Inn Road, is more to be relied upon than any that I have tried. The water with which it is mixed should be warmed to about 80°, and should contain a small quantity of salt in solution. In edentulous cases, and in some where

teeth remain, the common wax tray can be used. A little experience teaches one to recognize the condition in which the plaster is most effectually manipulated. It should not be thin enough to run readily from the tray, but at the same time it should be sufficiently soft to require very slight pressure indeed in taking the impression. One soon learns to judge with accuracy the quantity required in each case.

In the upper jaw it is desirable to bring the plaster into contact first with the back part of the hard palate, and then slowly to press the tray upwards and forwards. If the palate and the whole of the alveolar ridge be allowed to touch the plaster simultaneously, a portion of air becomes confined between the concavity of the palate and the surface of the impression, resulting in what we dentists term a "blow." The impression having been pressed sufficiently home, usually adheres by atmospheric pressure; but, if necessary, it must, of course, be supported by the operator. The patient being warned not to speak or swallow, may now be permitted to assume the upright sitting position, and the saliva which accumulates must be allowed to flow into a hand spittoon.

In the lower jaw, the lips being distended by the fingers of the left hand, the loaded tray is passed into position, when, guided by the right hand, it sinks almost by its own weight to the desired depth.

In simple cases and in those where no teeth remain, I think there is no advantage in retaining the plaster in the mouth until it approaches its hardest condition. After a little practice, one learns to determine, in different cases, when the plaster may be removed with safety. In the upper jaw, by drawing out the cheeks and gently tilting the impression, it is readily detached; and in the lower jaw there is rarely any difficulty.

I send round models of edentulous jaws, and of a lower jaw with six front teeth remaining, and these were the first I took in plaster with a common wax tray. It will be seen that the teeth are of a shape very favourable for detachment from the plaster. Should teeth be standing at divergent angles, or should deep undercuts be present, I should not attempt to take a plaster impression in an ordinary tray. For these cases I should make a special tray, similar to those I described when speaking of gutta-percha. The objects are to prevent the impression from becoming immovably locked, and to prevent it from being extensively broken in removal. These objects are usually accomplished by leaving uncovered the external surfaces of the teeth and other parts which we can dispense with on the model. I send round a tray of this kind.

Where a special tray is used, the impression should be allowed to remain in the mouth about two minutes, so that the plaster may become very

hard. It is then carefully withdrawn; and in this there is generally no difficulty, and the impression comes away unbroken. Should it, however, be fractured in removal, no great harm results. The broken pieces are put aside until they have become thoroughly hardened, and are then fitted into their places.

Having thus obtained our impression, we have next to go about getting a cast from it. In this I had at first more difficulty than in any other detail. The surfaces of the cast and impression became so closely and firmly adherent that the cast was usually spoilt in separating them. This difficulty is, however, very easily overcome. In the first place, the impression should be washed with a solution of soft soap, which entirely prevents any intimate union, and is much more effectual than either oil or a coating of soot deposited from a flame. In the next place, excepting in edentulous cases, there should be no attempt to remove the impression *en masse*. The superfluous plaster being removed, the tray is readily detached by a few gentle taps. The point of a blunt knife is then inserted at some point round the alveolar border and gently prised upwards. As soon as the surface of the cast is exposed at one spot, it is a simple operation to work round with the knife, and to remove in detail the remainder of the impression. By similar means in edentulous cases the im-

pression may frequently be removed entire. Such is the plaster of Paris process.

I may here anticipate one objection to this process which might be raised. It might be said that when a gold plate with clasps is to be made it is necessary to have a model showing the whole surface of the teeth, and as the plaster process fails in some instances to obtain this, it is in such cases practically useless. This difficulty can be thus overcome:—The plate being struck up, is inserted into the mouth, and an impression of the whole is taken in Stent's composition, or in wax. From this impression, with the plate imbedded, a cast is made, which comes away leaving the plate fixed in its exact position. The bands can then be adjusted in the usual manner. Here is a model of a mouth, and here is a second cast exhibiting the depression in which the gold plate has rested.

Plaster can be employed for taking impressions in the majority of cases. The exceptions will readily suggest themselves. They are exemplified by those in which it would be impossible to remove the impression without irreparably damaging it, and by those in which some peculiarity of the patients renders them intolerant of any prolonged manipulation about the mouth.

With plaster the disadvantages such as occur with other materials are obviated. There is neither "sucking," "dragging," nor contraction.

The material being semifluid, does not displace the most delicate fold of mucous membrane, nor depress any portion of the soft tissues, however flabby and yielding, It passes to the bottom of the most minute depressions, and thus produces a perfectly clean-cut model. It flows on to and copies surfaces, an impression of which cannot be obtained by other materials, even when most skilfully manipulated. All these properties are well illustrated by three models, which I have here, of the same upper jaw from impressions in wax, in gutta-percha, and in plaster. It will be seen that the cast from the plaster shows the contour of the whole of the rounded and undercut alveolar border, and that even a small flap of mucous membrane covering a fistulous orifice in the palate is perfectly shown. On the other hand, in the cast from the wax there is evidence of more or less "dragging" and "sucking," the small flap has been pressed up so as to be almost obliterated, and, instead of a rounded and deeply undercut margin, the alveolar border presents a flattened and undefined appearance. In the cast from the gutta-percha these defects are not so manifest.

There is an experiment which may be tried, in order to ascertain with what degree of unvarying exactness a material takes an impression. Let a piece of work be constructed upon a model obtained from an impression in the material to be tested. Let a second cast be obtained in the

same way. If the piece of work fit the second model as accurately as it did the first, it will be evident that the models are perfectly similar and exact. It might be objected, that although in such a case the models were perfectly similar, it does not follow they were true copies of the mouth, for each might have presented precisely the same faults. Theoretically this objection is a good one; but I think it will be agreed by every practical observer that it is impossible to take two impressions, the *defects* of which shall be in every respect similar.

This experiment will, I believe, afford more satisfactory results with plaster of Paris than with any other material. Next in order I should place Stent's composition, then gutta-percha, and, lastly, wax.

I must confess, that with every desire to be impartial, I can suggest no objections which will weigh against the advantages of plaster of Paris as a material for taking impressions.

The comparative value of apparatus used in any mechanical process must be decided by the degree of exactness with which each produces the desired result. In the case of impressions of the mouth there is the condition that a material which could be employed in a small number of cases only, however exact in its results, would be valueless compared with another which, although a little less exact, could be used in a great

majority of cases. On these grounds, if what I have stated be correct, plaster of Paris must be pronounced the most valuable material employed in taking impressions. It is for the Society to decide this point. But, should they agree with me, it by no means follows that every other material is to be banished from the operating-room. Fortunately, perhaps, it is probable we shall never be able to reduce any department of dentistry to a mere mechanical routine, and never discover any one material and one mode of treatment which will meet every case. For the exceptional cases in taking impressions, wax, gutta-percha, and Stent's composition will continue invaluable.

In conclusion, I must express the hope that at least I may have furnished sufficient matter for debate, and that the questions which I have broached may now be thoroughly discussed. If all the arguments in support of particular views be brought forward by those who hold them, I have little hesitation in saying that we shall have recorded in our Transactions a mass of valuable information on the subject of modelling, the study of which will tend to improve the practice of all of us. Should this be achieved, I shall have the satisfaction of feeling that the proceedings of this evening have promoted the interests both of the Society and of the whole profession.

Discussion.

After Mr. Sewill had concluded his paper, the President said this was a most interesting subject to discuss. Mr. Sewill's intention had been not to lay down any rules, but to place the matter before them in such a way as to elicit expressions of opinion. Probably what material each one used, that he would praise. He believed that in edentulous cases plaster of Paris turned out admirably. But when many teeth were present, or when they were undercut, wax he thought was the most successful. Perhaps those who used other materials would communicate their method of proceeding. He remarked that there was a vast difference in the quality of wax, and much resulted from the mode of softening it. He hoped each one would express his views on this very important subject. In looking at the models which were handed round during the reading of the paper, he did not see that gutta-percha was so superior; he thought that wax had held its own.

Mr. Ramsay advocated plaster of Paris. He thought a model could always be taken with it of the upper jaw especially, and often of the lower jaw also. If plaster of Paris were removed at the proper time, a perfect model was obtained. Other material did not break properly; but when the mouth was of such a form that the whole mass of plaster could not be removed at once, it fractured in such a manner that the parts could be perfectly united; and thus "drags" were avoided. That very day he had taken a cast of the mouth of an old lady in plaster of Paris. It was the most perfect case he had seen. He brought it with him exactly as he took it from the lady's mouth. Being disappointed of obtaining other models, he got his servant to sit down, and took a model of his mouth. He could easily have brought more, as he made a rule to take them in duplicate. He did not think plaster of Paris ought to be depreciated.

Mr. TURNER asked what they did with the undercuts when they occurred.

Mr. VASEY agreed with Mr. Ramsay as to the use of plaster of Paris. As to the uncertainty in the time it required for setting, he found a solution of alum serviceable in expediting it. . . . . It enabled him to regulate the time of setting more uniformly than warm water. He had experienced trouble in using plaster in undercut cases until it occurred to him to place wax round the undercut tooth or teeth. By this plan he was able to use plaster in these cases, and to withdraw it readily from the mouth, and thus obtain the admirable result which plaster gave.

Mr. TURNER said it appeared to him that Mr. Sewill's paper precluded any discussion. The only remark it appeared to him that could follow it was for gentlemen to point out certain hints and dodges, if he might so call them; such as the solution recommended by Mr. Vasey for hardening. In using Stent's composition he sometimes got the teeth puffy in shape, and not of their proper form. He should be glad to hear the experience of others, as he could not account for this fact.

Mr. WEST said he often used Stent's composition, and he must also complain of this puffiness in cases where the teeth were long. When he used wax and then cut it away, he overcame the difficulty.

Mr. MOORE (of Plymouth) considered pure wax the best material. The difficulty was to get the wax free from all contamination.

The PRESIDENT said that as to the enlargement or puffiness alluded to, the same took place occasionally when wax was used. It often existed when front teeth only are standing, and the ends of these nearly touch the tray.

Mr. WALKER had had some little experience. He never obtained the wax from shops, because it contained spermaceti, and was therefore less perfect. When he used wax he was careful as to the temperature of the water; also as to the temperature of the wax when introduced into the mouth. He kept the wax in the mouth about $2\frac{1}{2}$ minutes,

and during that time he allowed his patient to lean over a hand-basin, so that the saliva might flow freely into it. Before introducing the wax into the mouth, he examined the undercut with the mirror. With these precautions he obtained very fair models in wax. He tried gutta-percha some time ago, only he found it assumed a gouty appearance, and in other respects it was not safe to rely on it. Similar precautions must doubtless be used with gutta-percha and Stent's as with wax. They could not be too careful in keeping the patient quiet. For the last three years he had used plaster of Paris. He agreed with those who thought it was much the best material. He found a difficulty with the lower jaw in cases of hysterical people. There was a difficulty in getting the exact moment for introducing the plaster of Paris. If it is too soft, it runs down the throat of the patient; if too hard, you get an imperfect model.

Mr. Ramsay said that the proper moment for introducing plaster was when you could turn the tray in which it was placed without the plaster dropping.

Mr. Sercombe said all must be very much indebted to Mr. Sewill for bringing forward this subject. He was surprised to find the users of wax so silent. Perhaps it was because its supporters felt so sure as to its value; or could it be that the cases exhibited to-night so clearly established the superiority of other agents that nothing could be said in its favour? Everybody, he supposed, knew it must be pure, and not be overheated, to get the best results that the material was capable of: if overheated, it became scaly. It surprised him that all that had been said about wax had been apologetic. The Chairman, in his remarks, gave great praise to plaster of Paris in edentulous cases He (Mr. S.) supposed it was equally valuable in all cases in which it could be used, and he believed it could be used in all cases, with rare exceptions. He allowed skill was required in using it; but he did not think the difficulties in the way were insuperable. Even if it breaks, the parts are easily fitted together; therefore models can be got by it most satisfactorily. In cases of undercut, the dragging which overhanging teeth inflict on the model

when wax is used extends far on to the gum when the plate has to be fitted, and if you have to rely on a pared or trimmed model, you have to work to an imperfect copy of the mouth. They could not be too particular in getting the model perfect. The teeth will move slightly, and work fitted on models in which the undercuts are preserved can be got into the mouth in consequence, though to get it on to the models the teeth must be cut off. In reply to Mr. Turner, he (Mr. S.) thought it very desirable to have the undercuts represented on the model, and the work fitted into them, as it was important to have as little space between the work and the teeth as possible in the mouth, for the purpose of preventing the lodgment of food. He considered Mr. Sewill's model of the lower jaw, which had been handed round to-night, very satisfactory: it showed the accuracy of plaster. The gold plate on it had been made two years ago, from a plaster impression, and yet a model just taken of the mouth in the plaster fitted the plate so exactly that one might have supposed it had been made on it. That it was such a very good fit, and without any riding, spoke volumes, he thought, in favour of plaster of Paris. With respect to using plates in the lower jaw, the hints given by Mr. Ramsay were clear and sufficient. He had not found it necessary to be so very exact as to the second at which it should be introduced into the mouth. If this were necessary, cases would often arise in which, from nervousness on the part of patients delaying its introduction into the mouth a few seconds, it would not be available; but he had not encountered this difficulty. He laid no great stress on patients keeping their tongues still; in fact, he endeavoured to make it as little irksome to his patients as possible. On introducing the plaster into the mouth, he required his patients to sit forward and lean over a basin. By this simple precaution it was impossible for loose pieces of plaster to go into the throat: they must fall into the basin. He preferred salt to alum for hastening the setting of the plaster: it was more pleasant to the patient and answered quite as well.

Mr. Ramsay was careful to advise the patient not to move

the tongue when introducing the tray. He believed that plaster of Paris would have been more generally used but for the trouble of having special trays made for each case, as recommended by some. He used an ordinary tray for all cases, such as are to be bought at the depôts. The thing is to know the proper quantity, and the proper time to introduce it into the mouth.

Mr. Charles James Fox said that, apart from the obligations that he in common with every member of the Society must feel under to Mr. Sewill, he could not permit the evening to pass without expressing his own great personal obligations to that gentleman, not only for the paper he had favoured them with, but especially for the very kind and prompt manner in which he had supplied it at only a few days' notice. It was the duty of the secretaries to see that there was a paper duly provided for each meeting; and although through the session there was never any lack of papers at the service of the Society, still, for many reasons, there was often a little difficulty in arranging for the first evening of a new Presidency. On this occasion there had been a little trouble, as the gentleman who had been depended upon for that evening had disappointed him, and therefore he could not but very highly appreciate the ready kindness of Mr. Sewill, who had undertaken the task of preparing his paper in a very short time; thereby saving him, as Secretary, much trouble and anxiety. He felt they were also indebted to Mr. Sewill for bringing under their notice a subject of such a simple practical character, instead of considering it necessary, as some did, to confine his attention to one of the higher branches of dental science, although, indeed, few were more competent to treat of them than Mr. Sewill. Mr. Sewill observed in his paper that the use of gutta-percha for taking impressions seemed to be somewhat abandoned. He (Mr. Fox) thought this was owing to the fact that the article now supplied by the depôts was nothing like what it used to be. He could not but look back with regret to the beautifully plastic gutta-percha originally supplied to them by Dr. Putnam. It softened readily at a low temperature, and was not sticky or difficult to manipulate, and with it he had never found the least shrinkage;

but that now supplied by the depôts required so high a temperature to render it plastic, that it was impossible to apply it to the patient's mouth until it had been worked up several times, and then, after it had been used once or twice more, it became so adhesive or rotten that it was utterly valueless. He hoped, however, that now attention was drawn to the subject, he should have a better account to give of gutta-percha the next time the subject was brought under their notice. In using gutta-percha, he had never found it needful to retain it in the mouth more than four minutes. He nearly always made special vulcanite trays, and found it very useful to cover the surface of either gutta-percha or wax with a thin dusting of French chalk, also placing a little on the patient's lips. He found the removal of an upper impression much facilitated by directing the patient to utter the sound "Ha!" in a loud whisper; it tended to raise the soft palate and admit air between it and the impression. With regard to plaster impressions, he should be a warm advocate for them but for the difficulty he experienced in obtaining a ready-setting plaster; but after the information given them by Mr. Sewill as to where this could be obtained, he should certainly try plaster impressions again, for when well obtained nothing could possibly be more satisfactory.

Mr. Sewill in replying said he thought he might fairly congratulate the Society upon the result of the debate that evening. He had expressed the opinion that wax, as a material to be universally employed in modelling, ought speedily to become obsolete; and he thought the truth of this opinion had been established by the arguments which had been brought forward, and by the silence with which they had been received by the advocates of wax. These gentlemen, it appeared, could not deny the disadvantages of wax; could not point out any means by which the disadvantages were to be overcome; and could not bring forward any weighty objections against plaster of Paris and the other materials of which he had spoken. By the indiscriminate use of wax great unnecessary suffering was inflicted upon the patient, and great unnecessary trouble was given to the dentist. Take, for

example, work in edentulous mouths. Such work, constructed upon models taken from wax, kept up, almost invariably, for some time, irritation, by pressing upon soft parts, which had either been displaced in taking the impression, or which were imperfectly shown on the model. The patient was obliged to endure pain, and to return again and again to the dentist in order that the work might be gradually fitted to the mouth. Evils such as these were entirely overcome by the use of plaster. Mr. Sewill related a case illustrating the total absence of irritation and the perfect fit which resulted from this process. Such cases were in the daily experience of every one who used plaster; and had this not been so, he would have been almost afraid to bring forward an example, for the details must sound like exaggeration to those who had not employed that material. Mr. Sewill said he had not in his paper alluded to the opinions of others, as he had wished to avoid prejudicing the debate. In addition to the corroboration of his views which they had heard from those present, he might now, however, give them the opinion of Mr. Tomes on this matter; for he felt sure no opinion would be received with greater respect by the Society. Mr. Tomes had for several years entirely abandoned the use of wax, confining himself to plaster of Paris and Stent's composition. He had abandoned wax because it was open to all the objections which he himself had urged against it; and since he had given it up, all trouble and annoyance, both to himself and his patients, had been done away with. Mr. Sewill said that whilst he regretted that the advocates of wax had been so silent, he congratulated the Society upon the result which might be expected from their proceedings that night. The result would be that a blow would be struck at the practice of employing wax indiscriminately in taking impressions; and as he was convinced that that practice was unscientific and unjustifiable, he would be gratified if the blow should prove a *coup-de-grâce*.

The President said that Dr. Marcus Roeder, of Odessa, who was present that evening, had intended to relate the particulars of an interesting case which he had met with; but

the discussion had already extended so far beyond their usual time that Dr. Roeder had kindly consented to forward the particulars to be read at a future meeting. (Applause.) He presented the thanks of the Society to Mr. Sewill for his very practical paper; but he could not help thinking that if the advocates of wax had spoken, the tables might have been turned. He also thanked Messrs. Sercombe, King, Vasey, Fox, and Dr. Roeder, for objects brought before the Society that evening.

GENERAL MONTHLY MEETING,

Monday, March 1, 1869.

HENRY JOHN BARRETT, Esq., President, in the Chair.

The Minutes of the last Meeting were read and confirmed.

The following gentlemen were duly elected members of the Society :—

Mr. Arthur Baxter Visick, Ravensdowne, Berwick-on-Tweed.

Mr. J. Dennant, 1, Western Cottages, Brighton.

The following gentleman was proposed for the membership of the Society :—

Mr. George Christopher McAdam, Hereford.

Mr. F. G. Bridgman and Mr. J. Dennant signed the obligation-book, and were admitted members of the Society.

The following donation was made to the Library by :—

Mr. Kyan, of Preston, 1 vol. Sir Humphry Davy's Researches on Nitrous Oxide.

Mr. Vasey asked if any of the members of the Society had used, and if they would kindly give the result of their experience of the "anodyne cement," prepared by Mr. Mackenzie. He understood it had been used at the Dental Hospital.

Mr. Charles James Fox said that as no other medical officer of the Dental Hospital had responded to Mr. Vasey's inquiry, and Mr. Mackenzie had placed a packet of the filling

at his disposal for trial, he was bound to state what he knew respecting it. He had only had one opportunity of using it in private practice, and that was in a case where he had slightly exposed the pulp of a molar, causing great pain in so doing. After completing the cleansing of the cavity, he filled lightly with this cement: the pain passed off, and two days after he excavated the filling sufficiently to allow of putting amalgam over it, leaving Mackenzie's cement as a cap over the exposed pulp. The case had done well so far. Some of the students, who had tried it at the Dental Hospital, said they thought it might be used as a temporary filling for teeth with sensitive dentine: it would retain its place where no other filling would, and it had been found possible to excavate and fill a tooth thoroughly the day following the application of this material. He (Mr. Fox) understood them to say that the application gave no pain, but merely a sensation of heat; he was not in a position to give any opinion on the value of this filling, he could only give an account of what he had gathered from the students after only a week's trial; and so short an experience was of so little value that he should not have mentioned it had not Mr. Vasey brought the matter forward. Mr. Mackenzie, in a hurried conversation with him (Mr. Fox), had stated what the ingredients were, but he could not repeat them with certainty; he believed, however, that one bottle contained mastic cement, and the other some preparation of lime.

Mr. Sewill asked whether the preparation was correctly described as a cure for decayed teeth and toothache, and whether it was a secret remedy. If this were so, he thought the matter ought not to be allowed to pass without remark. There might be fifty different pathological conditions presented in diseases of the teeth, and the Society, as a scientific body, ought to protest against being told that one remedy, whose constituents were unknown, could be successfully applied indiscriminately in the treatment of all these conditions.

The President thought it savoured of charlatanism if the ingredients were not made known. Perhaps Mr. Vasey had some special reason for bringing the matter before them.

Mr. Vasey said his only reason for bringing the matter forward was that he had heard it had been extensively used at the Dental Hospital, and he was unwilling that anything that was of use should be put aside.

Mr. Coleman thought that, while they discouraged secrecy, they ought not to reject a remedy simply because it was a secret one.

Mr. Fox did not think that Mr. Mackenzie made a secret of the ingredients of his filling, as that gentleman had told him what they were: the fault lay rather with himself in not having better remembered, but he was much hurried when Mr. Mackenzie called on him.

Mr. Dennant, of Brighton, exhibited an instrument for registering time during the administration of nitrous oxide. He said he had found it very inconvenient to divide attention between watching the patient closely and calculating the time by the ordinary seconds hand of a watch; and the presence of an assistant for that purpose was objectionable, inasmuch as it gave to the patient an exaggerated idea of the seriousness of the operation; and he thought if an instrument could be made which would give the time palpably to the eye and ear it would be of great service. Some practitioners had felt the inconvenience of having to count time so much that they had discarded it altogether—a course which he felt, to say the least, was not wise. In the event of an accident, it would be desirable to show that every care and precaution had been taken. He was aware that skilful administrators of the nitrous oxide would watch for symptoms more than for time, especially as anæsthesia was produced so variously as regards time in different individuals; still, even experts would feel that in an operation reckoned by seconds it was always satisfactory to know how the inhalation was proceeding, and whether the patient had been inhaling 50 or 100 seconds. While so much prejudice existed in the medical as well as in our own profession against this agent, he felt that it was important that administrators should carefully register their cases, so that the full weight of facts might be brought to

bear upon those who were sceptical on the subject. When the Committee presented their satisfactory report upon this anæsthetic, he at once sought for some one to put his idea into execution, and he was fortunate enough in securing the services of a most ingenious man, Mr. Funnell, of Brighton, the maker of the smallest watch in the world, and the inventor of railway signals and other useful instruments, who at once saw the utility of the idea, and produced that instrument. They would see that it was not unornamental; the dial—a 60 seconds one—was about $4\frac{3}{4}$ inches in diameter, in a square case just large enough to hold it, and might be easily read at a good distance from the eye. It would go equally well hung on a wall or laid upon a table. Upon pulling the cord at the bottom of the instrument half an inch, it was wound up and started at the same moment, and at the expiration of half a minute, that is at figure 30, it would strike a bell, and continue to do so every half-minute until (upon the recovery of the patient) it was stopped instantly by pressing the stop at the side of the instrument, when the seconds hand would show the length of the operation. Again, by pulling the stop the hand would be liberated, so that it would move to point 60 at the top of the dial, and be stopped there, as the starting-point for the next case. The instrument had been used at the Dental Hospital, and approved, and, as some gentlemen present had seen it at work, he invited an expression of their opinion upon it.

Mr. Thos. Rogers asked if it was only meant for use during the administration of nitrous oxide.

Mr. Dennant replied in the affirmative, and in answer to a question whether it also counted the minutes, he said no, but that it went on for five minutes, and at the end of that time, by pulling the cord which wound up the instrument, it would go on for another five minutes, and so on, and it might be wound up at any moment, even when the stop was in, so that the operator need not fear that it would fail him during an operation.

The President asked if there was any starting-point.

Mr. Dennant.—No ; you allow the hand to go on to 60 and begin again.

Mr. Charles James Fox said, as one of those who had tried this indicator, he could not let the subject pass without expressing how fully he appreciated the perseverance which Mr. Dennant had shown in getting his idea efficiently worked out. He (Mr. Fox) considered the instrument a valuable assistant to the administrator of nitrous oxide. Whilst carefully noting the condition of a patient, it was not easy to follow the course of time by the second hands of a watch. Of course, it really mattered little how time went, as long as anæsthesia was safely induced ; but just now, when we were so carefully noting every point connected with nitrous oxide, accurate time was an important item in those statistical records which *every one* who administers this gas should keep. On this account, therefore, they were much indebted to Mr. Dennant for this neat and ingenious timekeeper.

The following paper was then read by Mr. Turner.

On Chlorœtherine as an Anœsthetic in Dental Surgery. By Mr. James S. Turner, M.R.C.S. & L.D.S., Assistant Dental Surgeon to the Middlesex Hospital, Member of the Pathological and Odontological Societies.

Mr. President and Gentlemen,—

The facilities for acquiring knowledge which are afforded by modern appliances, often render things which have been the work of a life, or the crowning efforts of a man's endeavours, familiar and common-place to us. In this ease of acquirement we are liable to overlook the value of the material which we possess; and in our eagerness for further possession, hurry on to seek for something new ere we have realized the full import of that which we characterize as old.

It is only when some scrutinizing and less impatient mind, guided, it may be, by some happy inspiration, or more probably by plodding industry, applies the means at hand to the production of certain results, that we recognize how near we have been, and yet how far distant, from at least a partial realization of what we most desired.

The latest development of the history of anæs-

thetics furnishes a case in point. Chloroform is old, nitrous oxide is older; we have gone from the one to the other, and now, for dental operations, the original candidate for favour is coming to the front.

With these considerations in view, I hope that no one will be disappointed by previous familiarity with the materials and combinations which I wish to bring before the Society this evening.

I have used the mixture in my surgery for upwards of two years and a half, and recommended its use to others when I have had a chance of doing so. During that time I have formed certain opinions concerning its merits, and with the object of having these views confirmed or modified, I wish to lay them before the profession.

At an early period after the introduction of chloroform, the idea of a diluent presented itself to the mind of the medical profession generally. In the year 1864 the Committee appointed by the Royal Medical and Chirurgical Society presented the results of its inquiries into the use and effects of chloroform, &c. &c.

In that report, which is published with the Society's Transactions for that year, we find that three mixtures were experimented upon by the Committee, with the view "to obtain an anæsthetic agent capable of producing the requisite insensibility, and yet not so dangerous in its results as chloroform."

These three mixtures were as follows:—

MIXTURE A.

Alcohol	1 part.
Chloroform	2 parts.
Ether	3 „

MIXTURE B.

Chloroform	1 part.
Ether	4 parts.

MIXTURE C.

Chloroform	1 part.
Ether	2 parts.

The first of these mixtures, says the report, was proposed several years ago by Dr. Harley.

"The second and third are mixtures which, it is believed, have been extensively used in America."

"The physiological effects of mixture B were the same as simple ether, but it was open to the same objections as ether itself; the chief being the slowness of operation."

"The mixtures A and C were similar to each other in their action, according with the fact that the proportion of chloroform was the same in both. Their mode of action was intermediate between that of ether and that of chloroform. Insensibility could be produced in man in from 10 to 15 minutes, and the effect on the heart's action was less depressing than that with chloroform alone."

"Of the two mixtures preference is given to A, on account of the uniform blending of the

ether and the chloroform when combined with the alcohol . . . . the alcohol which it contains probably stimulating the heart's action."

I will now turn from the report of the Committee of the Medical and Chirurgical Society, to a paper read before the Harveian Society by Mr. Lennox Browne, and afterwards published by him in the form of a pamphlet, entitled "Painless Parturition with full Mental Consciousness, with an Appendix on Modified Anæsthesia in Dentistry, by Isaac Brown, Esq." In this paper Mr. Browne says as follows:—"In commencing my experiments I at once decided to reject ether on account of its bulk and disagreeable odour. I selected alcohol as the diluent most desirable for my purpose; but to make the mixture still more agreeable in its odour as it evaporated, it occurred to me to add to the alcohol the essence of eau-de-Cologne. I therefore instructed my chemist to make some of the scent, not, as in the ordinary way, with one-half or one-third water, and the rest spirit, but with absolute alcohol. This rectified eau-de-Cologne was then added, in varying proportions, to chloroform. The most convenient proportion I found was one of the rectified eau-de-Cologne to two of chloroform. The result is, a clear, colourless, and highly agreeable liquid, having a specific gravity of 1·152. The mixture must not be confounded with a mixture of chloroform and

ordinary eau-de-Cologne. Such a mixture is most impracticable, because the chloroform is at once precipitated by the water, and does not evaporate till the water is dried. Nor must the mixture be made by mixing the chloroform with a spirituous eau-de-Cologne, in which the essential oil has been simply shaken up with the alcohol. In this case, although efficacious, it is very offensive, as the residuum of the essential oils is left to accumulate on the inhaler, and instead of being agreeable, is nauseating." Mr. Browne says he selected eau-de-Cologne as the basis of the scent, because of its popularity. He, however, found that a dilution of chloroform with simple alcohol, in the same, or even larger proportions, did not so effectually attain the desired object; and his friend Dr. De Wees, of New York, suggested that the "atoms of oil contained, but perfectly diffused through the mixture, may aid in preventing the too rapid evaporation of the anæsthetic." In the pamphlet there is also reference made to Dr. Sansom's work, published at a later date than the commencement of Mr. Browne's experiments, and the following extract made from it:—"In my own experiments," says Dr. Sansom, "I have found alcohol had the greatest effect in sustaining the heart's action during the influence of chloroform. I can particularly recollect one instance in which alcohol having been administered in vapour to a frog, it was impossible to cause death by any

strength of chloroform vapour. I certainly think that a dilution of chloroform with alcohol is desirable in many instances, and I am quite sure that the administration by the stomach of a little alcoholic stimulant acts beneficially."

With this rather lengthy, but I think necessary, extract from Mr. Browne's paper, I will leave this part of the subject. For those who would like to possess the pamphlet, I may say that it is published by H. T. Cook, 64, Edgware Road.

It will be seen from what I have said that the quantity of rectified eau-de-Cologne is as 1 to 2 of chloroform in the mixture. The mode in which it is administered is as follows:—

A napkin, such as is usually used in the dentist's operating-room, is folded to the shape of a cone, and secured with pins, the apex being left slightly open. Thirty minims or half a drachm of the mixture is then poured into the cone on the part of the napkin which will be lowest when it is adjusted over the mouth and nostrils of the patient. When this has been breathed by natural inspirations for one minute, another half-drachm is then poured on, and the inhalation allowed to go on a second time for the period of one minute; then the apex of the cone is turned down, the napkin being retained in position over the air-passages. By this means the atmospheric air, which has been passing through the small orifice, is excluded. The inhalation is continued 30 seconds

longer through the closed cone, and at the expiration of this time (in all $2\frac{1}{2}$ minutes), the operator should drop the napkin, and, with the forceps in hand, tell the patient, in rather a sharp tone, to open the mouth, at the same time applying a little pressure to the lower jaw. In a general way the mouth will open readily, and, in ordinary cases, one or even two teeth may be extracted without inconvenience to the patient. The first thing to be noticed during this time is the increase of the pulse. This takes place after one or two inhalations of the vapour, and generally continues during the greater part of the first minute, or, if it fail, it will immediately rise again on the addition of the second part of the doze.

The gradual influence of the vapour is marked in the usual way by stillness and unconscious breathing. In some instances these symptoms appear sooner than in others; but however soon they may appear, I go on with the administration for the prescribed time, namely $2\frac{1}{2}$ minutes, unless it be given merely to allay the agitation of a child previous to the removal of a temporary tooth. Its action in children is sometimes very rapid, and temporary teeth may be removed at a very early stage. On the other hand, some patients will show very slight symptoms of being under the influence of an anæsthetic. Under such circumstances I have been induced to continue the administration for a

longer period, and even to add an extra half-drachm of the mixture; but when I have done either the one or the other, I cannot assert that I have improved matters except in very exceptional cases. I have found the $2\frac{1}{2}$ minutes inhalation yields the best average results, and on the lapse of that time I operate immediately. In almost every instance the shock of the operation restores the patient to consciousness.

Sometimes, on the first exhibition of the vapour, there will be slight spasm of the glottis; but more generally this occurs when the second half-drachm is given. If the napkin be withdrawn, and the patient told to take a long breath, and the mouth and nostrils be covered up again before the termination of the inspiration, the spasm will generally be overcome, although in some cases not so readily as in others. Where the irritation is persistent, the admission of a larger amount of air through the small end of the cone, or by holding the inhaler a short distance from the mouth, is beneficial. In such a case a slight increase in the quantity of chlorætherine used, as well as in the time employed, may be found necessary, but not in every instance.

The patient will often scream violently during the operation, and sometimes begins before the instrument has touched the tooth; but rarely when recovered does a patient admit any knowledge of having made a noise. Some say they

felt one thing, and some another; but they all agree in saying that it would be no hardship to have another tooth removed under such circumstances. Many are much louder in their praise of the mixture; but for all practical purposes that is the substance of what is said. I at first found the mixture answer better in the summer than in the winter. To obviate this, I paid particular attention to the heat of the room, but did not find any good result from the precaution. Now, when the weather is cold, I air the napkin before using it. I have noticed that, however warm the room may be, the napkins, from being kept near a large window, as well as from their texture, have a cold feel in cold weather, and that this lower degree of temperature seemed to prevent the evaporation of the liquid; so now, when the napkin is folded, I hold the wide mouth of it before the fire till it has a slightly warm feel when the hand is placed inside it. By the adoption of this simple expedient, the mixture acts equally well in winter and in summer. As is usual in the administration of any anæsthetic, I take the ordinary precautions in reference to the freedom of the respiratory organs, and try, by the position of the head, to have the muscles of the neck as free from any strain as possible. The head may be placed in position for operating just before the towel is removed from the mouth.

In offering the advantages of this anæsthetic

to patients, I never promise entire immunity from pain.

I simply put it before them as a palliative, as something which will enable them to bear the operation without much effort, and so save them the shock and consequent prostration which frequently follow the mental effort at self-control, so necessary for submission to the removal of a tooth. In this way, while preventing them from expecting too much, I generally succeed in surpassing their expectations. This is as much of my experience as I can put on paper, and I hope I have said enough to indicate how the chlorætherine is to be given, and what is to be expected from its use. There are many little things which occur now and then to interrupt the course of the written law, but which are either overcome or made subservient to the desired end, according to the tact or wish of the operator. That invariable success is the rule, I cannot say; but as it would be bad philosophy to reject the good we can get, because we cannot get all the good we want, I do not expect to hear that defect brought as an argument against chlorætherine. I have seen chloroform fail in its object; but we would not discard it on that account. I have seen nitrous oxide fail from one cause or another; but we do not on that account question its general efficiency as an anæsthetic. If we refer to the deaths from chloroform tabulated by the Committee of the Medical

and Chirurgical Society, we shall find that ten cases are recorded as having occurred within the first minute; but in summing up, the Committee says that as the time in only a very few recorded cases was taken by the watch, it can only conclude that out of fifty-five cases mentioned, fifty-one died within the first fifteen minutes. But if we still take the bare fact of the ten fatal cases in the first minute, we shall find that where the quantity of chloroform given is stated, the amount is always greater than that used in Mr. Browne's system, while the distinguishing feature of the chlorætherine is absent; namely, the rectified eau-de-Cologne. The only case which makes a faint approach to the conditions indicated in this paper is reported as follows :—

"The subject was a United States dragoon, æt. 23, very intemperate. The mixture used was one part chloroform and two parts absolute alcohol. It was given first on a sponge in a bell-glass, and afterwards on a towel;—the quantity not stated;—never completely under the influence. Excitement followed the application of the towel; face became turgid, and the muscles relaxed; vomiting set in; the pulse, which had been 100 per minute, suddenly stopped; but there were two or three inspirations after this. A piece of cabbage was removed after death from the larynx. The same bottle produced unpleasant symptoms in six other cases."

In this instance the large quantity of alcohol did not prevent a fatal result. But the whole case is too loosely reported to admit of any very clear conclusions being drawn from it. We may, however, presume that the quantity given was considerable, from the fact that the mode of administration was changed, also that the heart's action had been well kept up till the appearance of the fatal symptoms, and that, if the removal of a tooth had been the object in view, it would have been done before they supervened, as the full influence of the vapour would not have been desirable. The intemperate habits of the man, and the piece of cabbage taken from the throat (wherever that may be), are disturbing influences, from which not much is to be learned, except that there must have been great carelessness somewhere.

A series of experiments made on the lower animals with chlorætherine, though interesting in themselves, have not been attended with sufficiently definite results to induce me to take up the time of the Society by entering them in this paper. I can only say, in a general way, that all the observations made tended to show that the chlorætherine sustained rather than depressed the heart's action.

The safe middle course which chlorætherine opens up to the dentist, and I may add to the general practitioner, has the advantage of leaving

some degree of sensibility to the patient. There is not that pallor nor death-like lividity which attends the nitrous oxide, nor that long, helpless insensibility which attends the use of chloroform, but which renders it so valuable in capital operations. The patient never seems to pass beyond the bounds of obvious safety; there is rarely any change of colour, and little or no muscular relaxation, while there is an amount of mental consciousness throughout the whole proceeding.

According to Mr. Coleman's authority, the amount of narcotism required to mitigate the pain of the removal of a tooth is not great. Chlorætherine seems to afford the requisite amount, and prevents that excess of suffering which is so enfeebling to the patient.

Then we have the absence of sickness and the rapid recovery which follows in the great majority of cases. These last features render the administration of the drug a saving of time in very many cases, as the patient does not require to be talked into submission to the operation. Another advantage is the small amount of chloroform used. At the end of the operation the napkin which has been used as a mouth-piece will still be found moist and smelling strongly of the mixture, so that the fair inference is that the 40 minims of chloroform which have been poured on to it have not all been inspired. The last advantage

is so obvious that I will only mention it: it is the absence of every apparatus.

I will now, with the Society's permission, relate a few cases illustrating how the administration of chlorætherine may vary in its results, and showing some of the disturbing causes which may interfere with its success.

The first I shall relate is that of a tall, well-grown, energetic woman about 40 years of age, who said she wanted to have a tooth extracted on my painless system. She had evidently formed some very exaggerated notion of the effects of chlorætherine. I tried to explain its nature, and would not promise entire freedom from pain. Although much disappointed, she resolved to have the tooth removed. Whilst inhaling the vapour she was rather restless, and when the second half-drachm was added she began to breathe deeply and to mutter. Her husband, who was standing by, said, "Stop, stop! we can have no more of this." I dropped the inhaler, and replying, "It makes no difference to me," removed the tooth. The lady felt considerable pain, and went away believing the chlorætherine a failure, and, I dare say, the dentist a humbug. I believe that had I been allowed to continue the use of the vapour for the usual time, this case would have been quite successful; but the disturbing elements which were imported rendered it a complete failure.

In the case of a young woman about 18 years of age, I had hardly applied the towel when she fainted, and remained insensible for a very long time. On learning that she was in the habit of fainting on every little occasion, I refused to administer any anæsthetic without professional assistance.

I had a case of severe sickness in a diminutive but healthy child of eight years old, and of a highly nervous temperament. Having timed the proper moment at which to operate in the earlier stage of insensibility, which, as you know, is very ephemeral in children, I gave an extra half-drachm. After two teeth were extracted, the child slowly recovered consciousness, became pale and sick, and vomited copious quantities of undigested food. It turned out that she had had many nice things for luncheon, before coming to me, the person who brought her being unaware of it. Here we have two disturbing causes. First, the overcharged stomach, which might of itself produce sickness, and second, the extra half-drachm of chlorætherine which was administered. When the stomach was evacuated, the sickness ceased, and the child recovered rapidly.

The next case is of a mixed character ; the patient was a female aged 28 years, very stout, complexion florid. She had been pronounced unfit for chloroform, although the medical man who brought her to me considered her quite safe.

There were four roots to be removed,—those of the six-year-old lower molars. While inhaling the vapour, she was very restless. After having continued the inhalation for the usual time, I raised the anterior root, the other remaining fast. She made a great noise and recovered immediately, declaring she had felt the extraction, and that it was dreadful. I induced her to have the posterior root removed without the use of the vapour. During the second operation she was much quieter and steadier than when under the influence of the chlorætherine, yet, on my wishing to proceed with the removal of the roots on the other side, she would not allow me to do so till she had the chlorætherine given again. She said the pain of the first root being extracted was much less than that of the second. During the removal of the other two roots, the same disagreeable scene was enacted; the patient was restless, and screamed violently, and required a separate dose for each root. After the operation it was half an hour before she could leave the house to drive home.

This, I think, was a case for a full dose of chloroform; but the difficulty was to overcome the objections of the patient. She believed her heart was diseased, and her fears on that score had, I believe, a good deal to do with her restlessness. As it was, the want of complete anæsthesia prolonged the operation, and made a great disturbance in the house, both of which are very

disagreeable things. Perhaps we might have had the same noise if chloroform had been given. There are peeple who seem to be born to give others trouble, and to upset all ordinary calculations.

A short time ago I had a tooth to extract for a very nervous female, about 18 years of age. When she entered the room, she showed very marked hysterical symptoms, and while in the chair was greatly agitated. The use of the chlorætherine was perfectly successful, and when I saw her a week afterwards, I was told that she had not been ill since the operation, although hysterical manifestations had previously been of daily occurrence. With such cases I have often found the chlorætherine a saving both of time and patience.

The last case with which I will trouble you, was that of a female aged 22 years, well developed, but very much below the ordinary stature. Her mouth was narrow and deformed. The upper wisdom tooth on the left side had been arrested in its eruption, and the crown was gone. I gave the chlorætherine, and removed the root without more difficulty than such a case usually presents; but unless I had been able to open the mouth to the fullest extent, and to work without the impediment of a gag, I could not have removed the root without considerable damage to the surrounding parts, or perhaps not at all. A quarter

of an hour afterwards I repeated the administration, and removed two teeth with like success. After a further lapse of half an hour I gave it again, and excised two front teeth and a canine, and filed down the roots before recovery. There was not a single unpleasant or untoward symptom from first to last.

I have said that on some occasions the patient will not show any marked symptoms of being under the influence of an anæsthetic. An instance of this occurred in the presence of Mr. T. W. Nunn, one of the surgeons to the Middlesex Hospital. The patient kept her eyes wide open, and was quite still from the commencement of the inhalation. When the $2\frac{1}{2}$ minutes had elapsed, she opened her mouth readily on being told.

I was a little longer than usual in removing the tooth. The patient sat quite still for several seconds after the operation, with her mouth and eyes wide open; then, bending forward to the spittoon, she assisted herself to water, and rinsed her mouth. Mr. Nunn was under the impression that she had felt the extraction, but she assured him that she had not.

I have frequently given the mixture before the house surgeons and students of Middlesex Hospital; and on a late occasion, in the presence of Dr. John Murray, at that time the chloroformist to the institution, I gave it in five cases in the space of thirty-five minutes. In my hospital ex-

perience I have found that the napkin used as a mouth-piece ought to be changed every second time. If used oftener than twice, it becomes saturated with the mixture, and the results are not so uniform as could be wished.

I have not referred to any male cases, as I do not recollect any one which calls for special remark. In this, as in the use of other anæsthetics, I think women give the most trouble. Still, I am of opinion that, if ever the use of this mixture becomes general, we shall meet with peculiarities in both sexes, which will demand our attention. It is not the isolated transactions of one man, however numerous they may be, but rather the combined experiences of a number, that are likely to teach us all we would like to know on such a subject.

From the experience which I have had I am satisfied that Mr. Lennox Browne's mixture, affording, as it does, a position between entire sensibility and entire insensibility to pain, is a most valuable agent in the hands of the dentist. To the operator himself it is a great comfort, for I am sure that no amount of familiarity with tooth-extraction can prevent the dentist feeling that he is inflicting a great amount of pain, and that in a most disagreeable way; for physical force often enters largely into our operations.

I have now to ask the kind indulgence and sympathy of the Society on a point I feel to be

part of my paper, and yet, owing to its extreme delicacy, a point which I approach with the utmost diffidence. I mean the question of personal administration.

I have always held the strongest objections to administer an anæsthetic and also be the operator. On the other hand, a professional man is bound to consider his patient first, and his own likes and dislikes afterwards; and I am bound to say that my experience with chlorætherine has enabled me to throw aside my aversion to personal administration. From the gravity of the symptoms exhibited, when other and more thorough anæsthetics are given, I would object, as determinedly as ever, to use them alone. With chlorætherine all such grave symptoms are absent.

I believe, with the gentleman who first introduced it to the profession, that it may be used with safety by the operator, who, of course, should be a properly qualified man, and by his hospital experience and education familiar with the use of anæsthetics and the symptoms which attend their administration. I may be wrong in thus advocating the work of chloroformist and operator in one, still I wish it to be distinctly understood that I prefer professional aid when I can get it. On the other hand, I cannot ignore the fact that, to the majority of people, a double fee for the extraction of a tooth is a very serious consideration. But I think it unfair on that account to

inflict pain when I have the means of alleviating it placed within my reach in the form of the liquid, the use of which I have been trying to describe.

It has lately been a great question in my mind how far we are justified in encouraging the use of those agents, the attendant symptoms of which are so grave, and the results, in some instances, so calamitous, for the minor operation of tooth-drawing, when we can use such an agent as chlorætherine. To my mind it seems better that, as in some instances, a little pain should be endured, than that a great risk should be run, particularly when that pain is so small as to be quite bearable without any shock to the patient.

These questions are now before the profession; and I venture to hope that, from the consideration which they will receive, we may be enabled to make an advance toward the truth.

The chlorætherine, prepared according to the formula of Mr. Lennox Browne, is sold by Mr. A. C. Trotman (late Dickinson), 16, Cambridge Street, Hyde Park, W.

Discussion.

At the conclusion of the paper the President said that Mr. Turner had no doubt greatly interested them, and although they would not be prepared to place chlorætherine in the first rank, yet he laid claim to more than they would be inclined to give from hearing his paper. He was sure it required more experiments to be made before giving their sanction to the anæsthetic. He would like to know the largest quantity of chlorætherine he had given. The cases mentioned showed that the administration was only partial, so as not to produce entire insensibility. However, the subject was very interesting, and there were many gentlemen present who had had experience in this matter, who he hoped would give expression to their views.

Mr. Braine asked whether chlorætherine would produce complete anæsthesia—such anæsthesia, in fact, that a capital operation could be performed? Also whether, in any of the experiments on the lower animals, the vapour of chlorætherine had been applied directly to the heart, and if so, what was the effect produced?

Mr. Sercombe said he had used a compound of chloroform and eau de Cologne as long ago as 1855. He used it on the first occasion to overcome the prejudice of a lady, who had an invincible dislike to the odour of pure chloroform. It occurred to him she might not have the same objection to it if it were diluted and made more fragrant. The mixture proved most successful. Not long afterwards it struck him that diluted chloroform might prove sufficiently anæsthetic for children, just in the same manner as weak brandy-and-water produced in a child the same effect that a stronger dose did in the adult. On trial his expectations were fully realized. He carried his use of the compound further. About eight years ago he administered it to a little child in whom he had a deep interest, previously to

a severe operation being performed for necrosis of the tibia. Unwilling to alarm the child, he administered it to her while taking her ordinary morning sleep. The pungency of the chloroform was so much lessened by dilution that it did not rouse the child from her sleep, but she passed quietly into an anæsthetic condition. Shortly after this case, being so impressed with the value of this diluted agent for children, he suggested to Mr. Prescott Hewett to have it used in a case in which they were mutually interested. With his consent it was employed, and the result was, as in the former instance, most satisfactory. On three occasions he had administered this compound during the accouchement of a near relation of his own. On the last occasion complete insensibility was maintained for two hours, during which more than three ounces of the compound were used. In his own special practice he had uniformly used this compound in the case of children, finding it sufficiently strong to produce complete insensibility, and sufficiently agreeable to be taken without resistance by the youngest child. With respect to the mode of preparing the mixture, he had never discovered the importance of such exactness as Mr. Turner described. He had always found the effects he had described produced by a mixture of equal parts of chloroform and eau de Cologne. If eau de Cologne was in excess, the mixture was turbid instead of being clear. On the occasion of Mr. Browne's paper read before the Harveian Society on this compound, being published, he (Mr. Sercombe) wrote at once to Mr. Browne, to inform him that there was nothing new in the compound to which he had given the name of chlorætherine, as he had used it freely for several years, often in the presence of medical friends residing in the district of Paddington, in which Mr. Browne used to live ; that he had freely spoken of it and recommended it to his friends ; and therefore, if any one could claim originality in the matter, he thought he could. Mr. Sercombe willingly corroborated Mr. Turner's opinion of the value of the compound. He might further add that the form of napkin recommended by Mr. Turner was the form he had used from the beginning, and he had found it most convenient.

Mr. Lennox Browne said that, as a visitor, he should

not have risen so early had not Mr. Sercombe rather inferred that he (Mr. Browne) knew Mr. Sercombe had used a mixture similar to chlorætherine when his paper was read on that subject at the Harveian Society.* On that occasion, when Mr. Sercombe received a reprint of the paper, a correspondence had ensued in which Mr. Browne had frankly admitted that all credit was due to Mr. Sercombe for the dilution of chloroform with eau de Cologne. But the fact was that this was not the point at issue. Mr. Browne had diluted chloroform with pure alcohol. The essences of eau de Cologne which were distilled in the alcohol might as well be those of lavender-water or any other perfume. Mr. Sercombe's mixture contained water, and it was in this important particular that Mr. Browne's mixture differed; for it stood to reason, as chloroform was much more volatile than water, that there would not be perfect mixture, and that as the handkerchief or inhaler got saturated there would each time be a further dilution, and a consequent greater difficulty in the evaporation of the chloroform. On this point he was confirmed by the observation of Mr. Turner, that in cold and damp weather it was necessary to air the napkin if you wished the chlorætherine to be given off freely. However, he was quite willing to give Mr. Sercombe all the merit of his invention, if such it could be called, though he must be allowed to express his surprise that amongst the many speakers at the Harveian Society none had referred to Mr. Sercombe's practice, nor had it ever been brought before the dental profession. For himself, he considered chlorætherine simply as a useful dilution of chloroform in cases of parturition, and had, by mere accident, as it were, discovered its value in tooth extraction. Being neither a chloroformist nor a dentist, he had not pushed the matter beyond his own circle of friends, and he was surprised, as well as pleased, from Mr. Turner's experience, to find that chlorætherine was likely to be of so much utility. He saw some gentlemen present to whose

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* "Painless Parturition," read before Harveian Society March 21st, 1867, by Isaac Brown, Esq.

patients he had administered it; amongst others Mr. Ibbetson, who had allowed Mr. Browne to give it in three cases—all children,—and he believed with satisfactory results. Mr. Ramsay had also authorized Mr. Browne to express his satisfaction with its effects in a case of a child, in which it was necessary to remove the four temporary lower molars : all were extracted at one administration. Mr. Browne considered that there was no operation more disagreeable both to operator, patient, and on-looker than the extraction of a tooth under chloroform, where, from the unconsciousness of the patient, there was danger of the blood running down the trachea, and other untoward effects. The advantages of chlorætherine he considered to be threefold :—1st. It was well known that by far the majority of deaths from chloroform had been where it was administered for extraction of a tooth or a toe-nail, or some similar affection, which had been preceded by many days and nights of pain, bringing the heart's action to a very feeble state. Chlorætherine, by keeping the heart's action at an even or in a slightly elevated state, contra-indicated this risk. 2nd. There was rarely sickness, and it was not at all necessary to caution the patient against taking a meal beforehand, as in chloroform, nor was the state of muscular contraction and struggling so marked as in chloroform. 3rd. It was difficult to produce total unconsciousness; so there was no necessity for a gag, and the patient was able to adapt his movements to the wishes of the operator, and also to cleanse his mouth without danger of being suffocated by the blood getting into the larynx. He might add, as a fourth advantage, the absence of any apparatus, which circumstance deprived anæsthesia of more than half its terrors. In conclusion, he considered chlorætherine very useful in those operations in which the pain was of a reflex character, and in which the risk to life from the shock of the operation was not sufficiently great to justify the risk to life of chloroform. He did not consider that chlorætherine was adaptable to cases of amputation, or in any operations in which the cutaneous nerves—by far the most sensitive—were touched by the knife. It was very useful in painful examinations of the uterus and of the urethra.

Mr. Sewill asked whether an undiluted vapour of chlorætherine would not cause death; and, as one could not be certain, when administering such an anæsthetic from a napkin, what amount was being inhaled, whether it would not be better to ascertain what was the minimum quantity required to produce anæsthesia, and to administer it with Mr. Clover's apparatus.

Mr. Vasey said it was not Mr. Turner's object to bring about total insensibility, but to bring the patient into the condition of being quite indifferent to the operation. He had seen Mr. Turner administer the chlorætherine many times, and in one case, on the previous Saturday, a patient on whom Mr. Vasey had to perform a very painful operation, it was in the highest degree satisfactory. He had formed a most favourable opinion of chlorætherine, administered as directed by Mr. Turner in dental operations.

Mr. Coleman thought the Society was much indebted to Mr. Turner for having brought before them the fact—one that they had often discussed in that room before—viz., that a partial state of anæsthesia could be induced in which the patient, without wholly losing consciousness, could go through an operation with little or no pain; and in patients of a naturally timid and nervous disposition such an object was a great boon. From the name given to the anæsthetic he was prepared to hear that it was some definite chemical compound, but it appeared to be no other than a mixture of chloroform with alcohol, containing certain essential oils, giving the latter the character of eau de Cologne. As already stated, the mixture of chloroform with alcohol was no new thing; indeed, such an anæsthetic was older even than chloroform. He remembered it being largely employed at the Metropolitan Hospital in 1857, but it was given up, upon the supposed ground of its increasing the tendency to vomiting. In the eau de Cologne the various essential oils might have a stimulating effect, and so render the anæsthetic safer than the mixture of chloroform and alcohol. Mr. Ellis, who had done much in employing mixed anæsthetics, had tried eau de Cologne to remove or mask the unpleasant smell of the ether; but, in

his opinion, it caused nausea, and he found a mixture of the essential oils of nutmegs and lemons better. In most cases, when mixed anæsthetics were employed, they did not evaporate uniformly, but in the order of their vaporizing points: thus, in the compound before them, when found on the hand the smell at first was that of chloroform only, and afterwards that of eau de Cologne. With regard to the question of the comparative safety of the agent before them, the facts contained in the paper could hardly be taken as any proof upon this point, but the paper was at the present time an important one, as diverting their attention from the agent which so largely occupied it, to those which could be administered much more readily and without formidable-looking apparatus, which terrified nervous patients, and especially children.

Mr. Ibbetson said he had had but a limited experience with chlorætherine, but, as Mr. Browne had mentioned his name in connection with it, he felt bound to say that, as far as it was possible to form an opinion from the few cases in which he had operated with it, it had been entirely successful, and he could confirm all that Mr. Browne had advanced with regard to it. Mr. Ibbetson added that his repeated use of the agent had been at the request of patients who had witnessed the successful exhibition of it at his house, and on each occasion it had been administered by Mr. Browne.

Mr. Oakley Coles mentioned an instance which had occurred. A physician insisted on administering the anæsthetic to himself; he told him (Mr. Coles) how it was going on, and at what time precisely he should operate. It was a most remarkable instance. There was perfect freedom from pain and at the same time perfect consciousness.

Mr. Turner, in replying, said he was disappointed in finding that no one had taken up the latter part of his paper. He administered the anæsthetic personally when he could not have assistance. He was quite satisfied in his own mind on that point, but would like to have heard it discussed. As to quantity, he never gave more than $1\frac{1}{2}$ dr., usually not more than 1 dr. As to whether it could be used for amputations, he

had never seen profound insensibility produced for a very long time. He had cut off three teeth and filed down the roots while the patient remained unconscious. He thought that would allow sufficient time to pass the knife round a limb, but did not know if there would be enough time for turning down the flaps. The recovery was very quick. He had not applied the vapour to the heart of an animal. He had no other object in bringing it before the Society than that of its being of use to the members. He thanked Mr. Sercombe for his favourable testimony to the use of chlorætherine, but disagreed with him in thinking that care was not needed in making the mixture. The eau de Cologne ought to be made with absolute alcohol, then distilled, and then mixed with the chloroform. As to who the inventor might be, all he knew was that Mr. Browne had made it public by publishing. Mr. Sewill asked if it would kill an animal? To this he answered he did not know. He gave chlorætherine to a rabbit in the same way as he would give it to the human subject and it did not kill it. Afterwards, the same quantity of chloroform given in the same way proved fatal. He was much obliged to them for the way in which they had received his paper. He thought the view taken by Mr. Vasey a fair one, that the chlorætherine gives the patient courage; he thought that was what was wanted. He did not care what name was given to it, he did not pretend it was a chemical, but only a mechanical compound. He thought, with Mr. Coleman, that safety was the most important element to consider; with this anæsthetic he had never seen a patient pass beyond the bounds of safety. Mr. Turner said he also had used it successfully in confinements. Mr. Turner concluded by again thanking the members for their courtesy.

Mr. Browne wished to add that he had had patients under chlorætherine for six or eight hours, and had administered it in large quantities.

The President said that if it was not a new, at least it was a valuable, agent, and they need not discuss who was the inventor. It was represented as without any of the dangers of chloroform. As to Mr. Turner's complaint that the latter

part of his paper had not been taken up in the course of the discussion, he thought the matter spoke for itself. If it was admitted that this anæsthetic could be given without danger, there was no occasion for any one to give it but the operator. He confessed his own views as to chloroform being administered by another person were very strong, but he thought with this agent that precaution was not so necessary. He thanked Mr. Turner, on the part of the Society, for his communication.

The PRESIDENT likewise presented the thanks of the Society to Messrs. Dennant, Vasey, and Kyan for their respective communications and donations.

GENERAL MONTHLY MEETING,

Monday, April 5th, 1869.

J. H. BARRETT, Esq., President, in the Chair.

The Minutes of the last Meeting were read and confirmed.

The following gentleman was admitted a non-resident member of the Society :—

Mr. Bevan Fox, Exeter.

The following gentlemen were put in nomination as non-resident members :—

Dr. Marcus Roeder, Odessa.

Mr. Alfred George Hayman, 4, Cumberland Place, Bristol.

The Secretary, Mr. C. J. Fox, announced that a donation had been made to the Society by Mr. Edwin Saunders of the following works :—

Fouchard sur les Dents, vols. i. and ii.; Mouton sur les Dents; Duval on Teeth (two copies); Delabarre sur les Dents, vols. i. and ii.; Delabarre, De la Seconde Dentition; Baumes, De la Première Dentition; Gerbaux on Teeth; Berdmore on Teeth; J. Jacobi Plenk, Doctrina de Morbis Dentium ac Gingivarum; Jullion on Teeth; Hertz on Teeth; Wooffendek on Teeth; Hurlock on Dentition; Parmly on the Teeth; Fox on the Teeth.

Mr. Charles Vasey read the following paper :—

On Gold Fillings. By Charles Vasey, Dental Surgeon and Lecturer, St. George's Hospital.

Mr. President and Gentlemen,—

In no profession is there greater need for good-feeling or charitable consideration towards each other than in ours.

The patients best satisfied with us keep to us, and even travel long distances to avail themselves of our services; while those who are dissatisfied with us, or those with whom we have not been successful, place themselves under the care of others. We therefore, as a rule, see the failures of others oftener than we see their successes. Losing sight of our own failures, yet often seeing our own successes, is apt to engender an unworthy self-esteem, that, it pleases me much to say, I believe exists but slightly among the members of our Society. I have also great pleasure in stating here, that after a long and extended intercourse with numbers of our members, I have ever found them willing, nay, desirous, of communicating to the profession at large any special knowledge they may have acquired. In fact, I know there exists

rather a self-depreciation than otherwise among our members. I have rarely visited a workroom or operating-room, either in London or elsewhere, without bringing away some little idea for useful application. Hence the value, I consider, of our discussions of practical subjects—inducing, as far as possible, every member to contribute his ideas of the same, and not to consider anything that he has found useful will be otherwise than the same to at least many of us. For years I have had the greatest comfort from a hint which a member gave me. The result is, in fact, of great value to me in its way: it is to boil our medicated wool in a solution of potash. The ordinary commercial potash dissolved and allowed to settle, then poured off free from impurities, answers the purpose perfectly. It seems to neutralize the greasy constituents of the wool, and to make it one of the most perfect absorbents of moisture. The manageability of wool with this additional absorbent property renders it, for all dental purposes, all I could desire.

Gold filling, the subject I have taken for this evening's paper, is one of paramount practical importance. The interest of it is ever new and varying, from the advance we make in the mode of preparation of the material, the construction of the packing and consolidating instruments, and other appliances used in our operations.

There are four preliminary principles to be

attended to in stopping teeth, that are entirely independent of the material to be used.

1st. Preparation of the tooth.

2nd. Shape of the cavity.

3rd. Removal of the diseased tissue.

4th. Cleansing and drying the cavity.

These may all be disposed of in a few words. Of the first, "Preparation of the tooth," there are two modes of treatment, which are entirely opposite in their results. The one may be termed Preserving, the other Chamfering or Bevelling; and the liking or tendency to either mode of practice will show itself through all our operations.

Some operators seem to cut without mercy; they slice and bevel away all thin or inconvenient parts of a tooth, regardless of how little of the crown remains, so that the plug may be made easy of application.

This tendency begets a rough mode of handling the teeth, so repugnant to many persons that I have often heard it said that no tooth was worth saving at such a cost.

The desire, on the other hand, to preserve as much as possible of the tooth begets a delicacy of handling greatly to the advantage of the patient, and leading to the utmost refinement in all our appliances, instruments, and materials.

The latter principle I act upon, uphold, and strongly recommend. I, however, desire it may be distinctly understood that I do not object to

a certain amount of chamfering, for I am constantly resorting to the practice; I advocate its being done, however, only for the purpose of rendering the operation of stopping more durable.

I have seen the greater part of the crown of a lower bicuspid cut away needlessly, and done evidently for the purpose only of facilitating the operation and saving the operator's time, and not for the purpose of saving the tooth.

Teeth so treated are never satisfactory during mastication, the pressure coming laterally on them, limits the freedom of their use, and invalids, as it were, all the other teeth on the same side of the mouth.

It is no doubt good practice to save the half of a tooth permanently rather than two-thirds temporarily. We should, however, always bear in mind that restoration must be our highest aim; and that the extraction of a tooth, or the destruction of even a part of one, marks the limit of our art or of our personal skill.

Of the second, "the shape of the cavity," I suppose all will admit that the beau ideal is such as a drill would make, with the slightest amount of undercutting in shallow cases; and that this type should only be departed from in accordance with the exigences or necessities of each particular case.

Of the third, "Removal of the diseased tissue," the most important part is the complete and per-

fect removal, as far as practicable, of the whole implicated structures.

On examining by the microscope sections of teeth in the earlier stages of caries, we recognize most clearly to what an extent and depth the disease penetrates.

I remember, many years ago, before the microscope was in such general use, looking over some of my specimens illustrating this point with a professional gentleman from the United States, one who had retired on a competency honourably earned by his successful practice of our art. He said he had always been in his practice very attentive to this stage of the operation; but had he been acquainted with the microscopical appearances, revealed to him then for the first time, he would have carried the operation of removal still further than he had been in the habit of doing.

The method of removing the diseased tissue even admits of variety. Some operators prefer to scoop away all that is necessary with a few vigorous cuts of a full-sized instrument,—that is, one as large as the cavity will admit. Others prefer using very fine instruments and devoting a few more minutes to this part of the operation. The latter I much prefer, as being more agreeable to the patient. I need only mention, for form's sake, the importance of working only with the sharpest possible instruments. I have often thought how well this necessity is exemplified in

the disagreeable operation of filing a tooth or root. While the file is driven forward and the substance of the tooth actually cut, it is comparatively painless; yet how unbearably painful is the jarring sensation when the file is drawn back, though scarcely any of the tooth is rubbed away.

We are all well aware also, of the painful twinge, or even shock, the patient experiences when the instrument touches the opposite wall of the cavity or the adjoining tooth, so as to press on either as a lever would.

The instrument should, therefore, be held clear, from the fingers to the cutting point, and it should be sufficiently small as to bear the necessary rotation without wedging in the cavity or space.

Of the fourth, "Cleansing and drying the cavity," little need be said. Some have spoken highly of the small syringe as an aid. In the use of it attention to the temperature of the water is very desirable. Both the glass piston and the elastic rubber syringe I have frequently used, but I consider neither of them an elegant appliance, I am glad to say I have not found the same necessity for using them since I have had the prepared wool to which I previously referred.

Of the two modes of preparing teeth, these preparations may be taken as illustrations.*

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* Preparations exhibited, which do not, however, admit of illustration.

All preparations of gold for filling teeth, whether in the form of leaf, or so-called Crystal, Sponge, Fibrous, or otherwise, may be classed under two heads,—Adhesive and Non-adhesive; and the operation of filling must be conducted in accordance with the peculiar properties of the material to be employed.

Gold in either of the abovenamed forms, when annealed over the spirit-lamp to a red heat, acquires the property of adhesiveness and welds together with the slightest possible pressure. This adhesiveness is almost neutralized when the gold is washed in water. I say neutralized, not lost; for it returns and returns in every repetition of the heating.

We here, at the very threshold of the subject, encounter a phenomenon of immense importance, and one that would itself furnish sufficient scope for an elaborate essay.

Little or nothing seems to be known of the peculiar metamorphoses undergone by the gold in the process of washing and annealing, and its power of changing from the adhesive to the non-adhesive condition, and back again, any number of times. Mr. George Ash, who has given great attention to this manufacture, thinks that a film may be left on the leaf and dissipated by the heat; I, however, believe that a far more important principle is involved here than mere deposition.

In our standard works on chemistry, and in the articles Hydrogen, important points are suggested that I think bear on this subject, as the following quotation will show:—

"Although oxygen and hydrogen may be kept mixed at common temperatures for any length of time without combination taking place, yet, under particular circumstances, they unite quietly and without explosion. Many years ago, Professor Döbereiner, of Jena, made the curious observation that finely-divided platinum possessed the power of determining the union of the gases; and, more recently, Mr. Faraday has shown that the state of minute division is by no means indispensable, since rolled plates of the metal have the same property, provided their surfaces are absolutely clean. Neither is the effect strictly confined to platinum; other metals, as palladium and gold, enjoy the same property. When a piece of platinum-foil, which has been cleaned by hot oil of vitriol and thoroughly washed with distilled water, is thrust into a jar containing a mixture of oxygen and hydrogen standing over water, combination of the two gases immediately begins, and the level of the water rapidly rises, whilst the platinum becomes so hot that drops of water accidentally falling upon it enter into ebullition. The best explanation that can be given of these curious effects is to suppose that solid bodies in general have, to a greater or less extent, the

property of condensing gases upon their surfaces, and that this faculty is enjoyed pre-eminently by certain of the non-oxidizable metals, as platinum and gold. Oxygen and hydrogen may thus, under these circumstances, be brought, as it were, within the sphere of their mutual attraction by a temporary increase of density, whereupon combination ensues. Coal gas and ether, or alcohol vapour, may be made to exhibit the phenomenon of quiet oxidation under the influence of this remarkable surface-action."

I cannot, however, dwell further on this interesting subject, but must proceed by saying that the most perfect examples of either adhesive or non-adhesive gold are required for dental purposes. The mode of producing them is no doubt different with each manufacturer, and results in a higher or lower class material.

I am in the habit of proving the capabilities of any specimen of adhesive gold by scratching a coin and packing a strip or two on the roughened surface, a plan I first saw adopted by Mr. Fox; by this means I can thoroughly judge of its adhesiveness, and its power of sustaining the fatigue of packing and consolidating.

With the non-adhesive I take a piece in my mouth and bite it into a pellet. By these tests I am enabled correctly to appreciate the peculiar qualities of different specimens and to adopt the best mode of manipulating with them.

In the use of adhesive gold we have an unlimited range of power to form stoppings from the most minute to the opposite extreme.

To insure a perfect result with this material two things are indispensably necessary; first, a proper instrument; secondly, a fixed point to build upon.

The instrument should be serrated, with short but sharp points, and so perfectly finished that it will freely leave the gold. The slightest irregularity on the point of the instrument, especially at the commencement of the filling, would greatly interfere or entirely prevent the formation of the fixed point. The instrument also should be as small as possible. We get the maximum solidity of plug and the minimum of pressure on the tooth in proportion as we lessen the size of the instrument.

The fixed point is either to be gained by solidifying the gold in some angular point of the cavity, or by making a small cavity or cavities as retaining points in a favourable situation. A retaining point once gained, a stopping of any size may be built upon it.

The gold may be prepared in various ways while the patient is in the chair.

It may be crimpled with the fingers or with the crimpling-plates, or twisted into rope: it may be used in lengths or cut into short pieces and stippled on piece by piece. It may be

cut into small pieces, and these crossed on each other, forming stars; or it may be rolled into cylinders, or made into pellets of almost any form. My present favourite method is one I have used for some time past: it is to cut the leaf into three or more strips, then to fold them with the aid of a gilder's knife and pad into ribbons. The breadth and thickness of the ribbon can be regulated to the greatest nicety to meet the requirements of any case. It has the advantage of being expeditious, keeps the gold perfectly free from the moisture of the hand, and in no way fatigues it in the process of folding. Having prepared the cavity or tooth, and the gold, and having placed the patient's head in a favourable position, I take up the gold on the point of the instrument and proceed to pack.

As I have already said, in the use of adhesive gold we have a wonderful range of power. It has, however, one important peculiarity, which I may call its only real defect, that is, its tendency to draw from the circumference when consolidated on the centre. The larger the stopping, the greater, of course, this tendency.

In adhesive work, this peculiarity must never be out of mind. I have seen numerous cases of stopping failing through this cause alone.

Minute cavities, examples of which I shall presently pass round, could only be filled, so far as my experience tends, with adhesive gold.

For a non-adhesive filling the leaf may be manipulated in the same way as for an adhesive one, and packed towards the strongest wall of the cavity in the form of folds, which should be left projecting freely beyond the surface of the tooth. When the cavity is well filled, a wedge-shaped instrument may be forced into the centre and the gold driven outwards to the circumference of the stopping. The central, or newly-formed cavity, may then be filled. This should be repeated as often as the strength of the tooth will admit.

Finally, the surface may be condensed and finished in the usual way.

The great value of non-adhesive work is the expansion of the whole mass when pressure is applied, irrespective of the part of the surface acted upon. And by using small instruments a wonderful amount of condensation may be gained even in cases of delicate and fragile teeth.

A few of the coin tests I have placed on card No. 0.

No. 0. Ash's 4 gr. adhesive, crimpled by the fingers.

„ 1. Do. do. and in addition passed through the flame of the spirit-lamp; found to work rather hard.

„ 2. Do. do. crimpled with the plates.

„ 3. Do. do. folded on pad and whole strips used; packed kindly.

No. 4. Watt's crystal sponge; adhesive qualities good, but more easily fatigued than good examples of leaf.

„ 7. 4 gr. Ash's adhesive folded in pad and stippled on in lengths to show the extra support of side wall.

„ 8. Kierson's fibrous gold; packed easily; a fine gold of the kind, rather hard when heated over the spirit-lamp.

„ 8. Same bridged over.

„ 9. A 4 gr. leaf of Ash's filed on top and cut at sides with scalper.

Card with stoppings of various sizes.

Round box with two specimens of gold sponge.

On this diagrammatic outline of principles which I have sketched, I think we may build up any peculiar mode of practice, and render it intelligible to others.

I remember being present when an operator of good repute was about to stop a tooth. To my question, Did he use much adhesive gold? he answered, "No; scarcely any;" and the next minute, after folding a strip of metal, he passed it through the flame of the spirit-lamp, and began to pack it with a serrated instrument. This he also said was his usual mode of proceeding. I have learned since that he is not the only member of the profession who does not clearly define to his own mind the important difference so simply

brought about in the working properties of the material, as that produced through the agency of the increased temperature.

It would seem at first sight an easy enough matter to build up and make good any lost part of a tooth, on the principle of gaining a fixed point and stippling on piece by piece to any extent; and in such cases as those in which the root is tolerably sound, and could bear the insertion of a screw-pivot, a new crown, or greater portion at least, might be so formed.

We are, however, limited by natural difficulties, such as the flow of saliva and secretions of the mucous membrane, and the power of endurance of the patient. The latter is to me, I must admit, a serious one. I have often enough thought with envy of those gentlemen whose patients seem possessed of iron frames, and rather enjoy than otherwise the going through the hands of the dentist. This feeling I very well remember having on reading, in "Harris's Dental Surgery," * that "the time required to fill a tooth well, by an expert operator, may be said to vary from thirty minutes to two hours and a half, according as the cavity is large or small, or favourably or unfavourably situated; and, in some cases, a much longer time will be required. The author has found it necessary in filling some cavities, to bestow as many as six hours' constant labour on the opera-

* 1855. Sixth edition, p. 297.

tion." In such cases one's admiration is divided between the patience of the operator and the endurance of the patient. Any means we can adopt, however, of facilitating the work and lessening the length of the sitting, and consequent fatigue of the patient, is most desirable.

The great majority of the cases we have to treat may be managed on one or another of the principles I have sketched out; in some, however, a modification or mixture of the systems becomes desirable; and I will here give an example or two in which I have found this departure serviceable.

In a large cavity on the buccal surface of a lower molar the plug has a great tendency to roll when the cavity is nearly filled; this may be so slight as at times to be overlooked, but will result in failure of the work. In such cases I am in the habit of first filling the cavity with folds of non-adhesive, and condensing it so as to have an irregular surface; I then make two or more openings in the plug, inserting in them adhesive gold; thus forming retaining points, on which I build the remainder of the filling of the denser material.

Large cavities on the masticating surfaces may be managed in the same way, though the shape of the cavities in this position lessens the risk of rolling. In all masticating surface-fillings great density is essential. Among the few examples of stoppings that have outlived the usefulness of the

teeth themselves, and fixed on the card No. 4, there is one in which the stopping has held, though largely worn away by the opposite tooth.

I have previously referred to the importance of every means being resorted to in order to facilitate the operation and to lessen the time required for the actual filling. I have lately begun a plan that I quite anticipate will assist me greatly in attaining in this respect a standard I have not hitherto reached, in the stopping of large cavities more especially. This plan is to have a set of instruments of different sizes, gradually ranging from the one that will easily fit the cavity to be filled, down to the smallest we use, arming each of these with a star of leaf, numbers of which may be previously prepared; these are inserted one after the other, beginning of course with the largest; when perfectly filled, the stopping may be condensed and finished in the usual manner. I know of no plan of filling a large cavity with adhesive gold by which it can be done in such a short space of time or with such a satisfactory result.

What has proved a great difficulty to many—stoppings at the necks of the teeth, I manage entirely on the adhesive principle, as here I can gain, with great facility, a couple of retaining points at the extremities of the cavity.

The cases, however, that, of all I experience, give me most anxiety, and that are becoming so prevalent in the present day, are those of the

white, chalky, fragile enamel, in which the enamel columns are so easily broken down and disintegrated.

Caries in teeth of this character spreads rapidly, and is developed at an early age, when strong objections are made to the use of artificial teeth, when personal appearance is considered, and a great desire generally expressed to retain the proper outline and form of the teeth. In such cases—cavities in the interstitial surfaces, and these are the surfaces generally attacked—I manage entirely on the non-adhesive plan: I pack a ribbon of gold in folds from the neck or upper portion of the cavity, down to the point of the tooth, leaving it projecting as far as the adjoining tooth will admit. I then insinuate a fine instrument between the teeth, and burnish the whole plug in. A non-adhesive filling, especially of thin leaf, managed in this way, may be compared to a piece of sponge or wool—the pressure on any part of it acts on the whole mass, gently pressing and moulding it into all the inequalities and irregularities of the cavity.

Among a number of cases of this description that I have treated, one patient wrote to me the other day, saying, "It is now, as nearly as possible, eight years since I consulted an eminent dentist (now deceased) about stopping my front teeth, which he assured me would be of no use, and that they would all break off in a few years.

I was then advised to consult you, and, I am glad to say, since you stopped the three front teeth on that occasion they have given me no trouble, and no further appearance of decay has even taken place since."

We are all familiar with a hard, dense, satisfactory-looking plug failing at some weak point within a year or two, and, on the other hand, with seeing a soft interstitial one lasting for many years. It is but lately I saw one of the latter, reported to have lasted between thirty and forty years, the work of the late Mr. Cartwright. I very well remember a remark made by one of our members while chatting over this very subject, that it was exactly like when something soft, such as a piece of wool, slipped into the hole of the wash-hand basin and effectually plugged the opening; whereas at another time you might be disappointed in not gaining the same result when intentionally driving a cork, even with some force, into the same place. Some little angularity allowing a slow but effectual escape of the water. I have observed the same result in the case of a wine-bottle, though the cork was driven home with considerable force.

I consider leaf-gold for our use should never be beaten thicker than four grains to the leaf, or one grain to every two square inches. When a thicker leaf is required, two or more of these should be pressed together. An enormously

thick, but very pliable leaf, can be produced by this means. I have a two-grain leaf that I occasionally use for very fragile teeth, and I believe if our four-grain leaves were made of two of these, a still more satisfactory result would be obtained than by the solid leaf now in use.

Taking a general view of the whole subject of stopping, and the various changes and improvements made in all connected with it,—at least, in my own practice,—I observe none greater than the gradual and remarkable change from large to small instruments. I find the smallest of those I used in years past are among the largest I use now. A set of instruments, the size of fang-fillers, that Mr. Evrard made for me I frequently use for stopping teeth, and, lately, I made a good large plug in an upper bicuspid with one of them.

The objection to the appearance of gold in the front teeth will always limit the extent of stopping in that part of the mouth, so long as the most useful and perfect of our work has to be done in that conspicuous material. I am frequently asked, more especially by ladies, if the gold will show in such a tooth if stopped; and to the answer in the affirmative they say, "I will let it go then altogether, and have it replaced by an artificial one." I remember while visiting a public institution observing a fine specimen of stopping in the front of an upper incisor of the official who was conducting us. I remarked it to an eminent provincial

surgeon who was of the party; he said, "Oh! is that it? I have often wondered how any one could be seen going about with a tooth tattooed in that manner."

Without doubt the most complex and difficult of our operations is a good stopping; it taxes to the utmost our study, skill, tact, and even endurance. Some few of us who are fortunately engaged among the upper ten, meet with fair appreciation of all the perfection to which we attain, but I fear the appreciation of the general public has not risen to an equivalent level.

On one occasion a gentleman from Paris consulted me. I observed he had a splendid filling in the posterior surface of an upper molar, like to a gold button let into the tooth. On my noticing it, he said he always considered a fee well invested in a good stopping. On my telling him it was honestly worth five guineas instead of one, he said many of his friends considered him extravagant for indulging in guinea stoppings.

In all other professions the fees have been greatly increased during the last quarter of a century, while in ours they have tended the other way. It is clearly our duty, and I am sure it is the desire of the whole of us, to do the utmost we can for those who consult us, and whose cases we undertake, and it is as clearly their duty to remunerate us in a corresponding degree. A certain portion of the public really appreciate our

efforts, and pay fairly for good work, and, in this metropolis a number of us have our time occupied at liberal fees; but the mass of the people make no distinction between stopping a tooth which takes half an hour and one that takes four times the time. I hope to see the day when the public will view our work as work of art, which it really is; and I think it is our duty on every occasion to do our utmost to educate them to a full appreciation and recognition of its worth.

I lately saw a surgeon remove the lens for cataract, for which he received fifty guineas, in addition to the ordinary fees for after-attendance —an operation that did not occupy more time than that for extracting a tooth, and certainly did not take more years of instruction or experience to enable him to do it than are required for many of our stopping operations. More than one of our leading barristers will not even enter court for less than a hundred guineas, and fifty seem to be about the upper general fee. Compared with the enormous amount of work and expensive material that we have to give for the same sum, I cannot but feel that we have allowed ourselves to get behind the times, and, in the matter of fees, have not kept up with the altered value of money.

Discussion.

The President said Mr. Vasey's paper had treated of matters of very great interest; if it had any fault, it was that of including too many subjects, and consequently touching any one of them but lightly. He would have liked to hear Mr. Vasey enter more fully into the details of his practice in reference to Gold Fillings. Much benefit, however, might result from the discussion, especially if those who had had long experience in the matter would give free expression to their opinions and views. The subject of filling decayed teeth was also one of so practical a nature, that those who had hitherto been silent would now have an opportunity of coming forward. He trusted also that the younger members and the visitors would enter freely into the discussion.

Mr. Thomas Rogers thought the matter contained in Mr. Vasey's paper might very well have furnished the materials for three different papers,—one on the general subject of stopping teeth, another on the respective merits of adhesive and non-adhesive gold, and a third on the question of fees. He considered Mr. Vasey had shown great skill in comprising so much matter in a paper of moderate length. In the remarks he was about to make he would confine himself to one point,—that of stopping teeth. Mr. Vasey seemed to think that, as a general rule, the cutting away of teeth preparatory to filling was carried to excess. He to some extent agreed with him; but still, understanding Mr. Vasey's remarks to apply to approximal cavities, he thought it advisable to cut away sufficiently to get at the cavity thoroughly and properly. In these cases different operators worked on different plans, and some would cut away more than others in carrying out those plans. He thought the best way to discuss the subject would be to take a series of cases, and endeavour to describe our *modus operandi* in each case. This, of course, could, however,

only be done generally and roughly within the limits of a discussion. Taking, therefore, first, the simplest case,—that of a small grinding surface-cavity in a molar tooth. Commencing the excavation with a spear-pointed rose-drill, he enlarged it with rounded, and countersunk it with flat, rose-drills, and then taking a strip of gold previously folded, he packed it firmly in concentric layers, fold within fold, and then condensed. In small cavities, only requiring a quarter to half a sheet of gold, one strip, if the quantity were accurately chosen, would suffice for the entire filling. In large cavities of a similar kind he broke down the walls with scallopers, finishing with round-headed drills and excavators; and if the cavity were very large, say requiring eight or ten sheets of No. 4 gold, he would make two or more pellets of two sheets each, pack them firmly against the walls, and fill in with strips of various sizes, continuing the use of wedging instruments till no further entrance into the gold could be effected. In approximal cavities,—as, for example, in bicuspid teeth,—he countersunk the cavity more before filling, because there was less danger in this part of fracture of the overhanging shell from the action of the opposite teeth in mastication. If they were large cavities, he used three pellets of gold, packing the first thoroughly against the side next the gum, and the two next against the lingual and labial sides. He then used the wedge carefully; especially at the points where the pellets came in contact, which were the weak points in these stoppings, and finally condensed. In elongated cavities, such as were frequently met with on the approximal surfaces of upper lateral incisors, he placed small pellets of gold in close contact with each other, from the end next the gum downwards, leaving them all slightly prominent, and then condensed. But he agreed with a remark which Mr. Coleman had made to him during the reading of Mr. Vasey's paper, that the effect of pressure upon gold is comparatively superficial, and does not extend far from the point of pressure. In all fillings he was careful to go thoroughly round the edges of the filling with a fine-pointed obturator towards the completion of the operation, turning the edges over towards the centre of the plug. After all the gold was packed and condensed, he polished in the

ordinary way. He had, of course, spoken only roughly in what he had said, and had confined himself to one point—that of stopping teeth. He would leave to others the discussion upon the relative merits of adhesive and non-adhesive gold, acknowledging that he almost always used non-adhesive, and thinking it better to limit oneself to one or the other, lest—the modes of working being so different—in attempting both, we should run the risk of not attaining perfection in either. He would merely add that he disagreed with Mr. Vasey as regards the syringe, believing it to be most useful for removing the *débris* of the operation; but he quite agreed with him about the advantage of the preparation of cotton-wool which he recommended.

Mr. Coleman said he did not presume to address the meeting because he felt he was superior to others in the execution of his gold fillings; on the contrary, his efforts in this direction fell far short of his desires, but he had given some attention to the subject, and chiefly from the cause he had just named. In his opinion no gold filling could be produced equal to that obtained by the employment of adhesive gold built up piece upon piece with the aid of the mallet. His experiments previously laid before the Society proved that the most solid gold plug could be obtained in this manner: at the same time this proceeding required the most scrupulous care and occupied a very considerable amount of time to be successfully carried out, more than the patient could usually afford, and more than the operator was likely to be remunerated for. The mallet process was certainly not agreeable, often indeed not applicable, owing to the position of the cavity, still it was less obnoxious than was commonly supposed. Again, good results were not always appreciated by patients, and "Oh dear, how it shows!" was not an encouraging reward for having spent much time in restoring in gold a considerable portion of a lost tooth. They had, to some extent, to bend their practice to the desires of their patients, and to adopt more rapid modes of practice than those by which probably the best results could be obtained. He believed no amount of papers upon the subject would ever make members of the Society good gold-fillers; and for this

reason, because he saw excellent fillings made in all sorts of ways and upon the most opposite plans. A good gold-filler must possess the necessary qualifications in himself: he did not mean to say that papers on the subject were valueless; on the contrary, they could all gather some useful hints from them, and he trusted Mr. Vasey's comprehensive paper would be a preface to several papers going minutely into the various points he had touched upon. On one point he agreed most fully with Mr. Vasey; viz., in preferring pluggers with fine rather than broad points, as with them the gold could be rendered more solid than with the latter.

The PRESIDENT said that Mr. Rogers had set an excellent example by limiting himself to the one point of detailing his mode of filling; if other gentlemen would follow this example, they would be able to get at the different modes in use. The paper was a very comprehensive one; even the three main divisions mentioned by Mr. Rogers were capable of many further subdivisions.

Mr. DE LESSERT, of Wolverhampton, asked for further explanation from Mr. Vasey in reference to the prepared cotton-wool mentioned by him; it seemed to him that it was the same as a preparation he had heard of fifteen or sixteen years ago.

Mr. WALKER remarked that with practice the left hand rendered essential service in packing with adhesive gold-foil; he had for some time used two pluggers to pack, in all cavities suitably placed. The left hand must have frequent and continued practice in the use of the instrument before much assistance can be obtained, but by perseverance the result quite repays all the first attempts. He had used adhesive and non-adhesive gold foil, but preferred using one kind for days without changing. The non-adhesive he invariably used for large cavities; the adhesive for shallow and small. Mr. Tomes's mallet instrument had been a great favourite with him until he had received many letters from patients desiring him to discontinue the use of it, which he did for some months; but on seeing that the plugs introduced by its means stood so well he

had again resorted to its use, only with much greater caution in its application, moderating the blow of the mallet to the position of the cavity, the condition of the tooth, and the nervous power of the patient. At a suggestion of Mr. Sercombe's, made to him on a recent occasion, he had paid more attention to the position of the patient: in long and tedious operations a reclining position for the patient, and a sitting one for the operator, was much to be desired.

Mr. LAURIE wished to inquire how Mr. Rogers made his pellets: when he had heard Mr. Rogers's plan, he would relate his own.

Mr. ROGERS said he had no particular plan, except that he took care to roll up the pellet as tight as he could, drying his fingers thoroughly before handling the gold.

Mr. LAURIE preferred crimpled or corrugated gold, folding it inwards and curling it with a fine instrument. In large cavities he pushed it laterally to the further end, first putting in the gold in the form of a cylinder. He did not find the syringe necessary. He preferred to have the cavity as nearly cylindrical as possible, and wiped it out with a solution of mastic in chloroform, to take up the small cuttings of softened bone. He went on drilling the gold surface and filling up until he could put no more in; he then condensed and finished off.

The PRESIDENT asked Mr. Laurie how he proceeded with interstitial cavities.

Mr. LAURIE replied that for these he used shallower plugs when there was sufficient space between the teeth; but, in other respects, he was not bigoted to one mode of practice more than another. Where there was little room, the adhesive filling was the best.

Mr. SERCOMBE felt the subject under consideration was of too much importance to be hastily disposed of, and therefore, as the time for closing the meeting had nearly arrived, he begged to propose that the further discussion of Mr. Vasey's most interesting paper be adjourned. He believed there would

have been a crowded meeting if it had been generally known that the subject to be brought forward was gold-filling.

Mr. Turner seconded Mr. Sercombe's motion, and hoped that, in the meantime, members would make a trial of Mr. Vasey's system of stopping with small stars and graduated instruments.

The President thought they would all agree with Mr. Sercombe; they would then be able to think the matter over, and be better prepared to discuss it freely. It would be wrong to allow so important a subject to pass without an exhaustive discussion.

Mr. Vasey said he had had considerable hesitation in coming forward before so many who had a much longer experience than himself. In reference to some remarks made, he said he was unwilling to bore them with too many details; but if there was anything he could do to help any single member, he should be glad to do it. He hoped some of them would follow Mr. Turner's advice, and try the system of stopping by means of stars; he found it the best mode by far.

It was then unanimously agreed that the discussion should be adjourned. The thanks of the Society were cordially voted to Mr. Saunders for his valuable donation of books, and with this the meeting separated.

GENERAL MONTHLY MEETING,

Monday, May 3rd, 1869.

JOHN HENRY BARRETT, Esq., President, in the Chair.

The Minutes of the last Meeting were read and confirmed.

The following gentleman was duly elected a member of the Society:—

Mr. Macadam, Hereford (Non-resident).

The President presented a tooth stopped thirty-seven years since. The operation was performed by an old and esteemed member of the Society, who formerly filled the office of President, and whose operations are well known to his professional brethren, but owing to his extreme modesty, he wishes that his name should not be coupled with such a simple matter. However it represents what was formerly done with gold as a material for filling teeth, and is therefore a valuable acquisition.

Mr. Hepburn.—Sir, I have the pleasure to introduce to your notice a rather peculiar case: it is that of a patient who retained the four lower temporary incisors until the age of twenty-seven; at that period they fell out, and, after waiting in vain some time for their successors, I supplied the deficiency

with artificial teeth. The cast of the mouth, which I have now the honour to present to the Society, has the teeth which fell out attached to it.

Mr. T. C. Vidler.—Sir, I beg to present to the Society models of the upper and lower jaw of a child two years and eight months old: up to the present moment there are in each jaw only three teeth—one central incisor and two molars, one on each side.

The President.—The cases exhibited by Mr. Hepburn and Mr. Vidler are both interesting as illustrations of some of Nature's irregularities.

Mr. Bell Longhurst.—I have brought for the inspection of the Society, an instrument which I have found of great service when filling the lower teeth. Every dentist must have felt some difficulty in keeping the patient's mouth open sufficiently wide, and dry, when making large gold fillings in the lower molars. About twelve months ago I constructed this instrument, hoping to overcome these difficulties, and find in the majority of cases it admirably accomplishes the purposes for which it was made. It is made in this way: here are two shallow silver trays, fixed at a suitable angle (these trays are lined with gutta-percha); attached to the lower one are two square tubes made of soft wire, into which the napkin-holders are inserted, and which can be readily adapted to the mouth. My mode of procedure is this: I take a roll of absorbing-paper (the French paper* exhibited by Mr. Vanderpant some time ago I find the best) and place it over the duct of Steno on the side where the tooth is to be filled; another is placed under the tongue, and upon that a small napkin of the finest diaper folded in the form of a horse-shoe; the gag is now inserted, and the patient directed to bite firmly upon it; the napkin holder comes down upon the napkin and holds it in position, arresting the flow of saliva from the submaxillary and sublingual ducts. I find this

* *Papier josef.*

instrument of especial service when I get stupid patients, I mean those (young people, for instance) who have no idea of assisting us, and who do not appreciate our operations : with this they are completely under control, as they cannot close the mouth or displace the napkin. There are some patients, however, who are unable to bear the mouth gagged ; in these cases I am obliged to have recourse to the old-fashioned napkin-holder, which is held by the patient. My own differs somewhat from those sold at the depôts ; it is double-ended, one end being made for the molars, the other for the front teeth—it is made of soft wire and can be easily adjusted. For this instrument I am indebted to Mr. Quinby, of Liverpool.

Mr. Longhurst also introduced to the notice of the Society a mounted swivel which he thought possessed considerable utility.

The President.—We all must be but too conscious of the difficulties alluded to by Mr. Longhurst, but I cannot exactly understand the working of his contrivance. I have no doubt, however, it is of great utility, and I should like to have an opportunity, if it were possible, to see the working of it. If Mr. Longhurst has no objection to show it in operation at the next meeting, it would be understood better, I think, than by description.

Mr. Longhurst.—I shall be most happy to do so.

The Secretary read the following communication :—

"*May 3rd*, 1869.

"Dear Sir,—By the authority of Messrs. Ash & Sons I forward to you the accompanying small mass of gold, out of which a section has been sawn. I prepared it in February, 1864, by hand pressure, with ordinary plugging instruments, to test the merits of the gold-leaf produced by English and American manufacturers. At the time I refer to, a strong prejudice existed in favour of that produce by our trans-Atlantic friends. The lump now under notice consists of the various

descriptions of leaf prepared by Messrs. Ash & Sons. The small section sawn out of it was reduced to plate, but is unfortunately lost.

"I am authorized, if considered worthy of acceptance, to offer it to the Museum of the Society.

"I am, Sir, yours faithfully,

"LAWRENCE VANDERPANT.

"To Secretary of Odontological Society,
Soho Square."

The nugget, which accompanied the communication, was received, and the President expressed the thanks of the Society to Messrs. Ash & Sons for this acquisition to the Museum.

Discussion.

The President.—The paper which is to be the subject of this evening's discussion will be in the recollection of the members of this Society who were in attendance at our last meeting; since then our memory has been refreshed by a very accurate report of it in our Transactions. In reading over that report it has occurred to me that the remarks there made, true in themselves, would have been even more agreeable to us if carried further than Mr. Vasey thought proper to take them. I hope he will feel disposed to favour us with a few further observations, and enter more into detail on the subject of which he gave us the heads in that paper. I believe, however, he prefers to wait until after the observations which the members may wish to make have been made, in order that he may have an opportunity of replying to them at the same time. It will be for you, gentlemen, to offer any remarks on any points that occur to you as important on the subject of this paper. There are various subjects, as all of us who are in daily practice know, in which we are often in embarrassment, and these are the occasions, at our periodical meetings, at which it appears to me we may very freely put questions, and elicit opinions from our fellow-practitioners on those embarrassing matters. I hope and I think that on this occasion there will be no hesitation on the part of any gentleman to express his opinions freely on the subject under discussion. This remark applies to our younger members especially, to whom it is particularly desirable, as well, indeed, as it is, in a degree, to all of us, to avail ourselves fully of these opportunities, and more especially when the subject is of such practical utility as that to be discussed this evening.

The following communications were read as contributions from country members:—

"*Darlington, May 1st*, 1869.

"Dear Sir,—The perusal of Mr. Vasey's interesting paper and the discussion thereon induce me to send you the sketch of a box I had made some time since, and constantly use, for Watt's Crystal Gold. The breadth of the box admits of a cake of the gold lengthways, and at one end are fixed six pins, upon which I impale the gold. I tear away portions of the gold as they are wanted with a slender pair of tweezers, and as the box is weighted with lead, this can be done during the process of stopping. Crystal gold is best placed in the cavity with tweezers or charging-tongs. Taking it up on the end of an instrument compresses and injures ('fatigues') it. It is best to use small instruments and small portions of gold, occasionally going over the work with larger instruments and solidifying perfectly as you go on, taking especial care to fill close up to the walls of the cavity.

"I have abundant evidence that thoroughly reliable, I might almost say unchangeable, fillings can be made with Watt's gold, and I think without more expenditure of time or waste of material than is required in other processes: there is no time occupied in preparing or annealing, and in my box it is always ready for immediate use. I would add that when carefully kept it retains its properties for an indefinite period.

"If you think this worth communicating to the meeting of the Odontological Society on Monday evening, please do so, as my contribution to the adjourned discussion.

"Yours faithfully,

"Wm. Fothergill, L.D.S., M.O.S.

"C. J. Fox, Esq.,
"Secretary to Odontological Society."

The President.—This communication is accompanied by a drawing to illustrate the box, but it would have been better if we had received the box itself.

Wolverhampton, May 1st, 1869.

"MR. PRESIDENT AND GENTLEMEN,—At the close of the last meeting I had the pleasure of a conversation with Mr. Vasey, and on comparing notes about the tendency of the plug to 'roll,' mentioned in his paper, that one sometimes meets with when filling with gold, I told him of a plan I have adopted in some cases to prevent it. He asked me to bring it before the next meeting, but as I cannot be present in person, I beg your indulgence for this, I believe, rather novel method of participating in a discussion of the Society.

"I might here suggest that as the country members now get the paper and discussion of the last meeting in ample time to make a communication of this kind for the next, they be invited to do so, and that these letters or papers be read, subject to the approval of the Council, at the time the President invites members to speak having any casual matter to bring forward. This would open a way to induce non-resident members to contribute their ideas, and in this manner very much extend the field of discussion.*

"Mr. Vasey referred to the practice of cutting away large portions of a tooth in order to make the plug easy of application, and remarked that in excess it begets to the operator a rough mode of handling, and is so offensive to some patients that they would rather let a tooth gradually break away and have it replaced by an artificial one, than undergo the infliction of having it so excavated.

"I am not advocating the abolition of the practice of excavating a cavity in order to remove the caries of the tooth, but I certainly think cutting away at healthy bone to accommodate its replacement by artificial means is an evil to be avoided as much as possible.

"After removing the diseased tissues of a tooth, how often we find a saucer-shaped cavity left, which of necessity must be

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* We commend this suggestion to the notice of our country members who are not able, through distance, to attend our meetings.—ED.

cut or drilled to retain the gold. Retaining-points formed by drilling are very frequently ineffectual if adhesive gold be used, as it has a tendency to draw from the circumference, and forms the 'roll' so greatly dreaded by the profession.

"The plan I have adopted to prevent this is simple and easy :—When I meet with a saucer-shaped cavity, I drill only two small holes, running in a lateral direction, so that if a drill were placed in each, they would meet a little above the crown of the tooth. I then get a small piece of gold wire, and after cutting it to a proper length, I bend it so that the points are as near to each other as the top of the holes in the tooth. With the aid of an instrument I then press the centre of the wire, and with a little force send it down the drill-holes. Care must be taken to cut the wire to a convenient length, so that when pressed into position the centre of the wire does not extend above the desired height of the intended filling.

"I then proceed to pack in the usual manner, and while filling experience no rolling of the gold, and when finished, the plug is literally dove-tailed into the tooth. I have found it a good plan to rough the wire before inserting it into the cavity.

"I send for inspection an example of my method.

"I have never met with any dentist who has tried this plan, but as far as my experience goes, it is much more pleasant both to the operator and patient than the means hitherto in use, and as a filling is not to be surpassed for durability, I shall be glad to hear the comments of your Society upon this subject, and would advise the members individually, should occasion present itself, to give it a trial.

"Alfred Alex. De Lessert."

Mr. Sercombe.—Mr. President and gentlemen, as I proposed the adjournment of the last meeting, probably I ought to open the subject this evening. The more I have thought over Mr. Vasey's paper the more I have felt the difficulty of saying all I should like to say on it in the short time usually allotted to each speaker on these occasions. I will therefore plunge *in medias res.* I will also take up the points I wish to speak on in the order in

which they best suit my purpose. I shall commence with the last. Without any *mauvaise honte*, I may venture to say that the motive power by which we work is the reward we are to receive for our labour. I always feel this to be twofold—pecuniary and reputational—if I may coin a word for the occasion. The former is essential; unluckily the need of the latter is not so universally felt. If the fee we receive is not remunerative, our work will soon show it, and then we shall lose the other moiety of the reward of our labour—our reputation. So long as the custom prevails of paying one and the same sum for stopping, so long will it follow either that a large class of cases will be badly treated, or we shall work at a loss. For instance, our gold leaf costs us 3½d. a grain; a four-grain leaf costs, therefore, 1s. 2d.; if five or ten or fifteen of these leaves are used, it does not require an elaborate calculation to show that a considerable sum has to be deducted from the fee we receive for the raw material employed. We have to add yet another element of expense, viz., the wear and tear of our instruments, before we can ascertain the amount paid to us as a reward for our expenditure of skill and nervous energy in one of the most exhaustive occupations I know anything about. It so happens that usually the cases which require the largest amount of material require a large amount of time and a vastly-increased amount of care in their treatment, and for these cases we, in this country, receive the same stereotyped fee as we do for the simplest cases. I think it follows either that we are too well paid for the latter class, or not sufficiently for the former. I incline to think we are not sufficiently paid. I believe it cannot be denied that in this country the occupation of a dentist tends to shorten life. It is only necessary to glance our eye over the roll of this Society from its formation, some twelve years since, to be struck with this—how many men in the very prime of life have been taken from us, and others invalided. But I must not digress further than is necessary to show cause why we should be liberally rewarded for our work. I do not attribute our meagre payment to illiberality on the part of the public; on the contrary, I believe no people on earth are more willing to pay well for good work than the English public, but they very properly need to be satisfied that the quality of the

work and the charge for it bear some relation to one another. I think it is probably due to the fact that we employ the term "*fee*" in connection with the monetary part of our business. The public idea of a "*fee*" to a physician is a guinea, and they suppose the dentist can scarcely expect a higher reward than the physician; and hence the middle and upper classes usually tender that amount (though, alas! but too often *minus* its silver lining) to their dentist. I recently spent two hours in stopping a tooth for a gentleman of large fortune and generous instincts; but acting upon this impression, he left a guinea on my table. Nothing, I was sure, could be further from his wish than to underpay me; but I need not say that I was much out of pocket by such payment. I venture to suggest as a remedy that we adopt the plan of charging for our time. This is a general principle upon which all may calculate their charges. It will not necessarily bring the fees of all operators to the same level,—any attempts to do this would be absurd; but such a plan would deprive us of all excuse for bad work. By the present system a man must be a *virtuoso* indeed who can resist the temptation to hurry his work when he knows that people are waiting for him, and yet, however much time he spends on the case in hand, he will only get the same payment as he would if he spent a short time on it. If we could agree together to charge on some common principle, we should soon find no difficulty in getting the payment we deem ourselves entitled to, and we should soon find amalgam and its *confrères* in our *corps de réserve* occuping a very useful but a very subordinate place: we should also soon find the oft-repeated phrase banished from our lips, "This tooth won't bear gold,"—a phrase I am convinced often used when a more truthful one would be "I cannot afford to stop this tooth with gold for a guinea." There is much more I should like to say on this point, for I believe it lies at the bottom of a great deal that we should like to alter, but I must forbear on this occasion. I will now, sir, address myself to the subjects specially brought under our notice by Mr. Vasey. I hold it to be essential to get the cavity to be stopped so thoroughly exposed that there is no difficulty in working in it. This I think may be done without any very rough handling of

the tooth. I will take, for instance, the approximal cavities existing on the distal surface of the second upper bicuspid and the medial surface of the first upper molar. I explore the cavities with a small excavator armed with wool, to remove all foreign matter. I then commence with the same small instrument to remove the decayed dentine ; then with an enamel-cutter I chip and cut down the enamel until I have a V-shaped space between the teeth of sufficient width to allow the plugger armed with gold to be carried to the upper margin of the cavity. At the last moment I pass a file over the inclined or chamfered surfaces of the teeth, to make them perfectly level. I hold it to be of the utmost importance that this levelling be carried to the upper margin of the cavity. At this stage I insert a small wedge of wood between the teeth, for the double purpose of pushing the gum well up above the upper margin of the cavity to be filled, and also to prevent any moisture creeping from the gum into the cavity during the operation. The insertion of this wedge is probably the most painful part of the operation, but it is very momentary, and the result is so valuable that it is well worth the discomfort. The next step is to have the margins of the cavity well finished, and very especially the upper margin—the one nearest the gum. I often spend minutes in trimming this margin, and I use for this purpose an instrument shaped somewhat like the bowl of a spoon. With it I not only trim the margin, but at the same time make my under-cut. I pursue the same line of treatment all round the cavity. When I have got the cavity into a condition that pleases me, I prepare my gold. For many years I have used Abbey's No. 4 non-adhesive. I take a leaf, roll it into a rope, and then cut it into pellets between an eighth and a quarter of an inch long. I provide myself with as many leaves rolled and cut in this fashion as I require. I roll and cut half-leaves in the same manner, and quarter-leaves. I begin with pellets made from the whole leaf. I carry one on the point of my instrument to the upper margin, and place it in one corner, leaving it projecting beyond the cavity. I carry a second into the other corner of the upper margin, and a third placed between them is generally sufficient to cause them to hold their places. With an instrument in my left hand I hold two con-

tiguous pellets in their places, and with an instrument in my right hand I proceed to consolidate the third pellet. I generally put one, two, or three pellets into this corner, and consolidate them thoroughly before I remove my left-hand instrument, which I then place firmly on the consolidated pellets, to hold them in their position, whilst I treat the other corner of the cavity in the same manner. So soon as I have enough gold in the cavity to prevent rolling, I commence to use the mallet. I work the gold throughout towards the edges of the cavity, endeavouring to keep it above them, so that I may have plenty of material for burnishing down. By this method, if there is any weakness in the plug, it is in its centre; if upon percussion I find it, I stipple the surface of the gold with a fine sharp instrument, and then use the same foil, made slightly adhesive by passing it through the flame of a spirit-lamp, to complete the stopping. I am bound to say that my experience with adhesive gold has been unfavourable. I have worked it most conscientiously, but have in almost every instance found after a period of two or three years, the plug to be unsatisfactory. I have frequently seen plugs which have stood the wear and tear of thirty, forty—ay, even fifty years—put in by the late Mr. Cartwright, and our esteemed friend Mr. Arnold Rogers, and I feel that with all the appliances of modern days there are few, if any of us, who surpass these eminent men in the quality of our work; and all their work was done with non-adhesive gold, for adhesive gold was unknown in their day. I will not venture to trespass on the time of this meeting further than to say my concluding remarks have been made in obedience to a suggestion from the Chair at our last meeting that each speaker should endeavour to make his remarks as practical as possible.

Mr. Ramsay.—I think, gentlemen, there is one point that has been lost sight of in this discussion. My opinion is that not more than one in twenty gentlemen practising as dentists can ever be what we term good pluggers, and if one in twenty proves a good plugger I am surprised. The whole secret of making a good plug is a natural gift. The maxim applies here—

"Poeta nascitur, non fit."

But we must bear in mind we have to deal with dentists. There is no use in saying that A, B, or C, whatever their education may be, can make a beautiful gold plug. As well might you assert that an ordinary violin-player could rival Paganini. Relative to fees, I think the operator who can make first-class plugs deserves higher fees than those whose natural gift does not enable them to do so. That brings me to a subject which I wish to mention. In America they have what may be termed pure dental surgeons; men who as students have shown natural gifts in that direction; and any one man who has shown mechanical skill is encouraged to cultivate it; and I think the day will come at no distant period when plugging teeth will alone occupy one branch of the profession, and others will attend exclusively to mechanical dentistry. This is obviously necessary from the nature of the case, for suppose to-morrow I have to fit in an artificial set of teeth for a fidgety old woman, and immediately afterwards am called upon to fill a fine cavity, why the fact is, after the previous operation I am totally incapacitated for doing it. You may arrange your practice as you please, but you will continually find that it is almost impossible for one man to attend properly to both departments, and the sooner specialties are created the better.

Mr. Lawrence Vanderpant.—I rise, Sir, with a great amount of diffidence and hesitation to address a few remarks to you; but your courteous invitation to the young members to take part in the discussion, induces me to come forward. If you refer to the date when I constructed that small plug of gold that Messrs. Ash & Sons have presented to the Museum, you will see that at least for five years I have taken a very considerable interest in the subject now before us. In the number for November, 1864, of the *British Journal of Dental Science*, a paper of mine appeared, entitled "Remarks on Gold Stopping," and I must ask you to remember that this was written five years ago, and some things are contained in it which were more original then than they are now. I remarked that previously to stopping a cavity it was necessary for the operator to determine on and

adhere to one principle—the Adhesive or the non-Adhesive principle. But if it will not intrude too much on the time of this meeting I should like to read an extract from that paper.

"In order to achieve successfully the operation of stopping, it becomes necessary to determine, previously to commencing, on a principle. Experience gives us the choice of two, viz., the Adhesive and non-Adhesive,—the one totally distinct and separate from the other; each requiring an entirely different system of manipulation, and producing a result equally varied. To enter into the subject of the respective merits of the two more than briefly I should trespass too much on your space. Therefore, as much as possible, my remarks will be confined to the Adhesive principle.

"The term itself is almost sufficient explanation of the basis of the system, but to those unacquainted with the extraordinary properties of pure gold, it may not be unnecessary to state that gold leaf, peculiarly prepared, possesses the same property as iron raised to a white heat; one particle may be inseparably united to another, in the same manner that several pieces of heated iron may be welded into a solid mass. The application of this principle, it is obvious, must be invaluable to the dentist.

"As a successful result depends mainly on the most scrupulous attention to the most trifling matters of detail, too much pains cannot be insisted on—

"The following, which I deem absolutely necessary conditions:—

"1st. The means (by a well-arranged operating-chair) of placing a patient in such a position as the case may require.

"2nd. Extremely perfect excavators and pluggers.

"3rd. A perfect freedom from moisture during the 'filling.'

"4th. Last and most important, the most carefully prepared gold foil that can be obtained.

"The position of the patient's head in treating upper incisores and canines is a matter of vital importance: it is needless to observe that it must always be an aim of the operator to avoid as much as practicable increasing the labial

portion of the cavity, therefore he is compelled to operate from the posterior, to do which it is requisite to place the patient in a reclining posture, with the chin raised as much as possible; by this means the backs of the front teeth are most conveniently exposed; hence a chair with a reclining back and a moveable head-piece is a *sine quâ non.*

"Having obtained the requisite position, the next point is to form the cavity in such a manner as not only to remove the existing disease, but to create some point of retention for a small portion of gold, without which the plug cannot be formed. In most cavities it will not be a matter of difficulty; but where there is, it will be necessary with a small sharp excavator to cut a small hole or pit, not large, but of such form as will firmly embrace the small particle of gold upon which the remainder is to be built. One, two, or even three such points of retention may be created, according to the size and position of the cavity.

"All provision having been made for the reception of the gold, the points of consideration now are the preparation of the gold leaf and the description of plugging instruments to be used. With regard to gold leaf, much prejudice exists in favour of various American makers. I have found myself that that of English manufacture is quite equal to any introduced. A sheet of No. 8 I pass carefully over the flame of a spirit-lamp, or what is better, a broad flame of diluted gas, with a pair of long scissors cut into strips, twisting them into something the form of a rope; then cut off particles varying in size from $\frac{1}{16}$ to $\frac{1}{4}$ of an inch, and placing them on a wire gauze frame over a flame, raise the temperature of the gold to about a red heat. By this means, if the gold be good, it is absolutely and perfectly adhesive. The instruments must vary of course, but in all cases the points must be carefully serrated, and the various small points made sharp by what is termed a 'screw-head-file.' A blunt, badly-formed, working surface to a plugger will make cohesion difficult with the best gold.

* * * * * *

"The insertion of the gold should be effected as rapidly as possible; if by any chance its surface becomes moistened, all

its adhesive property is lost; in such a case it is better to dry perfectly the gold and form therein a small cavity; fill and proceed as in the first instance. The state of the gold when the plugging is completed is identical with that of a roughly-cast ingot, and in order to reduce it to a burnished surface, a properly-shaped riffler will be requisite, after which burnishing may be completed in the ordinary way.

"A plug formed in the above manner possesses advantages over any other method, inasmuch as it is *absolutely* solid, impervious to all the secretions of the mouth, never liable to crumble, and does not necessitate an inordinate pressure in manipulating. There are, undoubtedly, difficulties in the way of achievement in certain cases; the lower jaw generally is extremely difficult to keep free from moisture; indeed, candour compels me to state that I rarely succeed in plugging a moderate-sized cavity situated in it with gold on the adhesive principle. There is no medium between a good stopping and a very bad one, therefore I urge that a good amalgam plug is better than an indifferent gold one."

While on the subject of the thickness of gold, I would call the attention of the members to Mr. Arthur's work, in which he very discursively enters into the subject. He states that he sometimes uses gold No. 30—that is to say, I presume, 30 grs. to the leaf; but further on he says he prefers No. 10. You are aware that he advocates the adhesive principle. For myself I should say, No. 8; but in some cases I should agree with Mr. Arthur, when he says No. 10: in my opinion, there are occasionally instances where we desire to build up a mass, when we may use No. 12 with great advantage. In the paper already referred to I state the great difficulties I found in plugging lower teeth, in consequence of the accumulation of saliva. I wrote this paper in 1864; I am now compelled to confess that much that I then advocated, I have since found to be of less value in Practice than Theory, and the principle to be of very limited utility to the dentist. That small mass of gold (referring to the above-mentioned present of Messrs. Ash & Sons to the Museum) bears quite sufficient evidence that it is *possible* to form a most solid mass by passing the gold

leaf through a flame; but it is important to remark that the moment the slightest vapour touches the gold all its adhesive power is lost. In attempting to form that mass, I at first found it impossible to make the gold adhere, and did not observe that a considerable quantity of water was boiling in the room, which produced a vapour; after many fruitless efforts, a friend who was present suggested that, possibly, the vapour might be the cause which prevented the gold from adhering, and such proved to be the case. Therefore I am satisfied that, for practical purposes, we must adopt some other means than the adhesive principle in a great majority of cases. Mr. Arthur, in his work, says that a want of knowledge of what appears to be unimportant details, leads to difficulties; and, if I am not taking up too much of the time of the Society, I should like to make a few remarks on some small points of practice to which I have devoted patient and careful attention. With regard to drying the cavity, Mr. Vasey passed over that, assuming that every operator would know how to do so, which, doubtless, every operator does; but we have different ways of going about it; my plan is to use the syringe very freely, for the purpose of washing away any particles that remain after cutting, which invariably do unless expelled by a vigorous effort of the syringe. After that I cleanse the cavity with cotton wool, charged with chloroform, finally absorbing any remaining moisture by means of amadou, which is most effective for the purpose. To keep the mouth *absolutely* free from moisture is impossible, in my humble opinion; for though we may restrain the flow of saliva, which we can do with tolerable success by means of the thin *papier josef*, there is yet constantly moisture in suspension, which in itself is quite sufficient to prevent our making a thoroughly perfect plug by adhesive means a matter of any certainty. If, however, we can obtain gold pliable and soft like a kid glove, we have got something more valuable than the metal in any other form, using it much in the manner described by Mr. Sercombe; but the classic aphorism, *medio tutissimus ibis*, will suggest to us not to rely wholly on one method, so that by combining the use of annealed gold (or adhesive) with non-adhesive, a very solid and serviceable plug may be effected by simple and rapid means.

During the time that I relied on the adhesive principle, I found that notwithstanding I occasionally made apparently beautiful plugs, in the course of a few months a dark line surrounding the cavity was observable, plainly indicating that the secretions of the mouth had penetrated, that mischief was going on, and, much to my chagrin and disappointment, in the course of two or three years the plug fell out. At our previous meeting Mr. Coleman spoke highly of the utility of the mallet, but as his remarks and experiments had reference to gold inserted into pieces of ivory, and not into teeth in the mouth, they scarcely had a practical bearing. If it were possible to introduce into the patient's mouth a "Nasmyth hammer," or extract the tooth for the purpose of operating, we should hear but little of the difficulties or failures in connection with gold stopping. I trust I may not be considered presumptuous in my remarks, but it appears to me that everything printed assumes something of authority and importance, and as our Transactions cross the Atlantic, and in fact circulate through the world, we should all, I am sure, regret any opinion emanating from this Society which did not evidence our advancement.

Mr. Coleman.—I feel very sorry, Mr. President, that I should have expressed myself so inadequately at the last meeting as to give Mr. Vanderpant the opportunity of misconstruing me. He has succeeded in making me feel very uncomfortable by talking of our remarks going through the world and crossing the Atlantic. (Laughter.) I simply recommended the use of adhesive gold with the mallet, and I can safely assert that the most dense plugs can be made in this way. Mr. Coleman then referred to some recent experiments of making plugs with ivory, and their comparative merits with those made of adhesive and non-adhesive gold by the use of the mallet, and their comparative density.

Mr. Bridgman understood Mr. Coleman to say that he thought the best stoppings were made with the aid of the mallet, but that it was not always applicable. He then exhibited a mallet made by Mr. Collins for him,

which he found he could use in every case, and with no greater discomfort to the patient than Mr. Tomes's instrument occasioned; and when patients were told that better stoppings could be made with it, they generally submitted to it. Mr. Bridgman went on to explain that the point was at right angles, and could be readily changed; that he could work it with either the right or left hand—with either the thumb or the forefinger. The first case that he used it upon was the distal surface of the first right lower molar; he prepared the cavity in the ordinary manner, cutting away as little as possible, leaving the walls strong. When the tooth was filled, the hammer was used, and a hole as large as a small shot was made by it; this was then filled, and the mallet used again, until the stopping was found to be very hard and no further impression could be made upon it.

Mr. Mummery.—I feel reluctant at this hour to intrude any remarks on the meeting, but there are one or two practical points to which I would like to refer. The simplest mode I have found for drying the cavity is to use small spills of amadou in preference to cotton-wool or any other substance. And with regard to filling, I have tried the whole range of the different kinds of gold-filling, English and American, and I have arrived at the conclusion that we may, by practice, learn to prefer any gold for filling. I now get Messrs. Ash & Sons to make their old numbers two and three gold, and it has only been with considerable difficulty that they have been able to produce the identical texture with the amount of adhesiveness which these possess. I have not found anything so satisfactory as these, for, after a long series of years, stoppings made with these numbers have come home from India and various other parts of the world quite perfect, and I cannot say the same of any of the other forms of gold I have used. Therefore I have induced them (Messrs. Ash & Sons) to go back to the old numbers, two and three. They are not so adhesive as what they call adhesive gold, nor so inadhesive as what they call non-adhesive gold; but if you anneal this gold it becomes singularly adhesive, so thoroughly so that it becomes troublesome. As to the mode of arranging

it, I have tried cylinders and pellets, and so on, and after many experiments I use the gold folded in stars according to the size of the cavity, of either narrow or broad dimensions, as the case may be. I pack first with them; I then use pellets. I then turn the ends all over, and in this manner I thoroughly incorporate the outer with the inner ones, and I then fix them with two excavators. There is one other point on which I think we ought to compare notes, namely, on the approximate size of the teeth, but at this advanced hour I must postpone any further remarks on the subject.

Mr. Lawrence Vanderpant.—I beg, before the discussion closes, to express my regret at having apparently misunderstood Mr. Coleman.

Mr. Vidler.—I cannot help making one observation before we close. I have, within the last twelve or eighteen months, seen some very interesting objects in dentistry. There was one stopping especially which was done by Mr. Arnold Rogers, the history of which I was able partially to learn. It was done twenty-seven years ago, and is still in a splendid state. I should like very much to know whether the gold used at that time was finer than any used at the present day. Perhaps Mr. Rogers would tell us which gold his father used thirty years ago, and whether he uses the same now. I have seen another stopping put in by Mr. Fox thirty-two years ago, also in excellent condition. These two are certainly the most remarkable objects in dentistry that I have ever seen.

Mr. Mummery (handing to the President the tooth).—This stopping is of great antiquity. The operation was performed by the late Mr. Wake fifty-one years ago, and was in an excellent state of preservation and perfectly undiscoloured until it was knocked out by the lady's great-grandson (laughter). It is very striking (laughter) as an instance of what was accomplished before all these pains were taken to make special gold.

Mr. Thomas Rogers.—The gold my father used at the time

Mr. Vidler refers to was Abbey's No. 6. He used it in strips packed concentrically. Mr. Vidler is correct with regard to the specimen of stopping handed round ; it certainly is interesting as an evidence of what might be done in days when adhesive foil was not thought of. Although there is great force in what Mr. Ramsay said about "born" dentists, I yet feel that there is a good deal in having a strong will, and in being thoroughly earnest and honest in one's work, and I speak from personal knowledge when I say that with this something may be accomplished without exactly being born a dentist.

The PRESIDENT.—As the hour for closing the Meeting has arrived, I now call on Mr. Vasey to make his concluding remarks.

Mr. VASEY.—I am not quite sure but that the remarks of the members would bear out my assertion that the subject is one of great interest to our profession. I think the necessity is obvious for working upon principle, for then we know what we are about ; and this forms the great distinction between the empiric and the professional man. We can assign our reasons, and, knowing our reasons, we can explain them to our pupils intelligently ; and as a consequence, their progress is certain and satisfactory ; while, according to the unsystematic plan, it was all a chapter of accidents. I think the fact of our assembling here periodically is a great advantage, as it enables us to explain to each other from time to time the mode of practice which experience teaches us is best. I was surprised to find that Mr. Rogers prefers the non-adhesive gold, while another gentleman expresses a strong opinion that many operations could not be performed by non-adhesive gold. Experience enables me to say that any cavities, however small, may be stopped by adhesive gold ; and knowing Mr. Thomas Rogers's work, I was perfectly certain the gold he used was such as Mr. Mummery referred to, but if you start with the two principles, you cannot do it with the purely non-adhesive gold. Since the last meeting I have had two specimens put in my hands—adhesive and non-adhesive, and I found the non-adhesive was the better of the two for adhesive

purposes. A piece of leaf put to the spirit-lamp is useless to make a good stopping with, and you find it condenses on the surface; so that in using the expression adhesive, I mean a fine specimen. It varies with each manufacturer, so that it may be either pliable or the reverse. With respect to fees, I think we might benefit ourselves and the public by having some uniform scale of charges. I think a committee on this subject would be very useful. There is a recognized scale of charges in almost every profession. The young barrister, perhaps, only gets a guinea on his first brief, but afterwards he may receive one hundred or more, according to the importance of the case; and the same applies to the medical profession. In our profession, of course, different individuals may be differently placed; one man may be placed in a capital under high rent and proportionate expenditure, and a large fee to him may be equal to a small one to a country practitioner. And again, men make different charges—a guinea, a half-guinea, down to five shillings, according to the class of society in which they are placed; and this is obviously necessary, for it would be absurd for a man whose position is thrown among the lower grade of the middle class, or a still inferior class, to expect the same remuneration for his work as those whose practice is among the aristocracy. But notwithstanding this, I think there should be some basis on which to calculate the fees,—with regard to time, for instance. We might determine on a certain fee for a certain time—say half an hour—and if the operation occupied a longer period, to charge double that fee if the time were doubled, and so on proportionately. There is one point which I don't think we should lose sight of, and that is, that we should have a fee from every person who enters our consulting room. No barrister allows a client to come into his chambers without requiring a fee; but in our profession people call upon us over and over again for our opinion, which often costs us a good deal of time and careful examination, and yet they do not think they ought to be required to pay unless an operation is performed. Some time since a titled lady sent her governess with two children to me for an opinion, and after a very careful examination

I found that no operation was necessary. I, however, charged a fee of a guinea, believing that such an examination required far more skill than any ordinary operation, such as taking out one or two teeth. I received a communication saying that my charge was considered exorbitant and unreasonable, but I wrote explaining the amount of labour and skill the necessary examination required, and showing that a straightforward, honest opinion was really better than an operation. This explanation was received as perfectly satisfactory, and I am thankful to say that I still retain these clients, and I do not believe that any dentist will be likely to lose anything by adopting a similar practice. With regard to our being able to do one class of work better than another, I am quite convinced that that is a fact; and further, I believe that one day we are better able to do the same class of work than on the next. And some men are better suited for one branch or specialty of the profession than another—just like a genius in a particular art or science. But I think, as much as possible we should work on principle, especially in the teaching of pupils. As far as this has been observed it has been productive of admirable results, and we see pupils growing up around us who have accomplished stopping at the end of the year with a degree of proficiency that the old practitioners did not arrive at for many, many years. This is rather a desultory way of answering the observations of the members, of which I am fully conscious, but I do not know that I have any more to add except to thank you for the kind manner in which you have received the Paper, and to mention that I had no idea of making professional capital out of it.

The PRESIDENT.—The clock admonishes me that it is time to thank Mr. Vasey on behalf of the Meeting for his excellent Paper, as well as for his reply to the observations which have been made on it. It has also served another good purpose, as it has been the means of inducing some to speak this evening whose voices are not often heard, and of eliciting some valuable opinions. I have also to thank, on the part of the Society, those gentlemen who have brought specimens and instruments

as presents to the Museum, and I may mention the names of Mr. Fothergill, Mr. Vanderpant, Mr. Longhurst, Mr. De Lessert, Mr. Hepburn, and Mr. Vidler.

The PRESIDENT announced that at the next meeting of the Society a paper would be read by Mr. Snape, of Liverpool, "On Electricity as an Anæsthetic in Dental Operations."

GENERAL MONTHLY MEETING,

Monday, June 7, 1869.

JOHN HENRY BARRETT, Esq., President, in the Chair.

The Minutes of the last Meeting were read and confirmed.

The following gentlemen were duly elected members of the Society :—

Dr. Marcus Roeder, Odessa (non-resident).

Mr. Alfred George Hayman, Bristol (non-resident).

Mr. Charles James Fox exhibited a new form of gag invented by Mr. Bordecker, and made by Mr. Coxeter, for use in the mouth with nitrous oxide. It consists of a silver tube, about an inch long, within which slides a solid metal shaft, with notches corresponding to a spring in the tube to regulate the length : the usual string is attached to this spring, so that when the operation is over, it is only necessary to pull the string and release the spring, when the gag closes and falls out of the mouth. The ends of the gag are made of vulcanite, grooved and notched as usual.

Mr. Arnold Rogers presented to the Society a first upper bicuspid, which he had extracted that day from a patient's mouth. The upper portion of the roots were absorbed, apparently, by the pressure of the canine tooth, which, from abnormal position, was retarded in its eruption. He (Mr. Arnold Rogers) regarded it as a very rare specimen, for during his lengthened practice he had not met with a similar case. He had often met with the lateral so absorbed, but he had never before met with the bicuspid in this condition.

Mr. Aaronson exhibited an apparatus for securing a correct articulation of models.

Mr. Bell Longhurst announced that since the last Meeting he had considerably improved the apparatus he then exhibited for the purpose of keeping the patient's mouth both open and dry during a prolonged stopping operation. The improvement had been suggested to him by Mr. Thomas Rogers, and carried out by Mr. Coxeter. It consisted in an adaptation of Mr. Clover's gag, with which—although it had been exhibited at a previous Meeting of the Society—he had unfortunately not made himself acquainted.

Mr. Coleman said, Mr. Coxeter has sent for exhibition this evening an apparatus for the administration of nitrous oxide gas. This pedestal contains in its interior the thirty-six gallon bottle of compressed gas, described at a former meeting by Mr. Fox. This small rubber tube conveys the gas from the bottle to the silk air-tight bag; this bag Mr. Coxeter has divided into two, communicating by a valve which allows the gas to go from the first to the second compartment, either upon pressure upon the former or a strong inspiration from the latter, the object being to economize gas; the bag is connected with a brass vessel which stands upon the pedestal, and into which, when about to be used, quick lime, slightly moistened, is introduced; a diaphragm in the centre of this vessel ensures the gas passing well over and through the lime; a tube from the lime apparatus has connected to it the facepiece, one similar to that employed by Mr. Clover, excepting that there is no inspiratory valve, *i.e.*, one opening towards the facepiece, and that Mr. Coxeter has, in the place of an air or stuffed pad, supplied a water pad, which I have tried and can speak most highly of.

In employing this apparatus the lime should first be placed, after having been slightly moistened, in the brass vessel, and, this being securely closed, a small quantity of gas—a pint—should be forced from the bag through the vessel; about a gallon and a half of gas should then be pressed from the first into the second bag, and the whole is quite ready for use. In trying this apparatus—the purifying portion of which Mr.

Coxeter constructed according to my plans—at the Dental Hospital, we found that the thirty-six gallons of gas were sufficient for the production of anæsthesia twenty-five times—in some of the cases anæsthesia was produced twice, and in one case three times, in the same patient, by simply adding about half a gallon of fresh gas to that the patient had previously breathed. When employing any form of apparatus for the administration of nitrous oxide gas when the same is to be breathed over again, I deem it advisable to allow the first two exhalations to escape at the exhalation or exspiratory valve, but afterwards I close this with my finger.

This tripod is for the support of the lime apparatus, when the same is employed in connection with a gasometer and not with a vessel of compressed gas.

Mr. Sewill exhibited two supernumerary teeth which he had recently removed from two patients, also a model of a mouth in which the permanent central incisor had passed through the gum anteriorly to the shedding central incisor, which was persistent.

On the Treatment of Chronic Peri-odontitis by Replantation. By Alfred Coleman, Esq., F.R.C.S., L.D.S., &c.

The intention of this short communication is rather to suggest than to recommend a plan for the treatment of that most intractable disease, chronic peri-odontitis. We cannot, upon this occasion, when our time is bespoken for the consideration of another question, enter upon that of the pathology of chronic peri-odontitis, but its general features, we know, are enlargement by congestion of blood, effusion of serum, and interstitial deposition of the membranes surrounding the fang or fangs of a tooth, whilst portions of their substances are generally found in a more or less gangrenous condition; the consequence of which is, that the organ, if not positively painful, becomes invariably so whenever its services are called into requisition.

In cases of acute, as also in cases of chronic following the acute forms of this disease, our American neighbours adopt a plan of treatment rational in principle but difficult of execution. They enlarge the opening in the alveolar process, or, if none exist, make one, and through this

scrape away as far as possible the diseased membranes surrounding the fang of the tooth; and, afterwards, by combined stimulating and antiseptic remedies (iodine dissolved in creosote), provoke the formation of new connective tissue. I am not aware that this plan of treatment has been adopted in cases of ordinary chronic periodontitis; it may have been; but to scrape away the whole of the diseased membranes surrounding even a single-fanged tooth must be a proceeding more easily described than accomplished. It had long occurred to me that by the removal of a tooth in this condition, carefully scraping from its fangs its diseased membranes, clearing its pulp and fang cavities, filling these, and then, after washing it, as well as the alveoli, with antiseptic fluid, returning it, we might hope for such a condition of things as usually attends the replantation of healthy teeth.

The objection to this mode of practice presented itself in its painful character, but the introduction of a comparatively safe and agreeable anæsthetic has removed this objection.

The intention of putting my ideas into practice was suddenly determined upon witnessing the very successful results of a case of replantation, for the sake of destroying the nerve of a tooth approached by a cavity concealed by the gum, and which could not be rendered accessible for the application of arsenious acid, occurring in one of

my patients at St. Bartholomew's Hospital, under the care of Mr. Lyons, a pupil there. In this case there was no disease of the peri-odontant membrane, so that Mr. Lyons simply extracted the tooth, filled it, and returned it.

I have performed the operation in question too seldom and at too recent dates to enable me to draw any conclusions that could be considered trustworthy as to the probable success of the same; but I was anxious to bring the subject thus early before the Society in the hopes that, during the interval which must elapse before I could arrive at any certain conclusions respecting it, other workers might be able to pronounce upon these conclusions from their own experience.

The PRESIDENT.—Perhaps, after the author's statement that he has only brought this subject forward to-night in order that his views may be tested between this and our next meeting, in November, it is unnecessary now to discuss its merits.

On Electricity as an Anæsthetic in Dental Extractions. By Joseph Snape, Esq., L.D.S., Liverpool.

Mr. President and Gentlemen,—

I consider the discovery of chloroform, and of nitrous oxide gas, as among the greatest boons ever conferred upon suffering humanity. It must not therefore be supposed that the paper I am about to read is an intended effort either to supplant or to oppose their use. On the contrary, I think it is the duty of all who appreciate their value, and have satisfaction in their employment, to use them to the best of their abilities for the mitigation of pain. There are, however, many practitioners who, from various causes, are averse to the use of either of these agents in tooth-extractions, yet would be glad of a perfectly safe and easy method of rendering the operation comparatively painless. Such a method would also be a great consolation to many patients, who prefer suffering any amount of pain rather than run what their nervous timidity leads them to imagine might be a fatal risk.

During the last ten or eleven years I have been using electricity for this purpose, with satisfaction to myself and comfort to my patients, and find

that it gives no extra trouble and does not occupy more time than an ordinary operation, while there is nothing obtrusive in its appearance. Indeed, it rests with the practitioner himself whether the patient knows that electrical agency is or is not used. During these years I have had thousands of opportunities of verifying the fact that, when properly employed, it will so mitigate the pain as to reduce it to little more than a curious sensation.

It may be well here just to mention that I lay no claim to being an electrician, or one versed in the technical phraseology of the science. I merely use its agency as one does that of heat or light, without possessing more than a general knowledge of their laws. I must therefore beg to be pardoned if, when I speak of shocks, currents, vibrations, vibratory motions, &c., I do not use the language of science, but simply describe, as familiarly as possible, the sensations experienced by myself and those upon whom I operate.

When, in 1858, the results of my first experiments were published, the subject excited intense and general interest. A few in the profession still feel this interest, and have continued to use the electrical anæsthetic; but by the majority, however, it has been abandoned, chiefly on account of the character of the anæsthesia produced, the want of manageable electrical machines, of pro-

perly insulated forceps, and of other minutiæ necessary to success, which time, attention, and perseverance can alone develop. There can be no doubt that Mr. Francis, of Philadelphia, was the first person to use electricity in a systematic manner for the purpose of producing local anæsthesia in dental extractions, but to whom the merit of the discovery is really due remains a mystery—though many claim it. Mr. Morrison, of Edinburgh, in a letter to the *Times*, also published in the *British Journal of Dental Science* (vol. ii., p. 296), claims to be the discoverer. Mr. George, of Paris, who was the first to repeat my experiments in France, wrote to me at that time, saying that two persons in that city also claimed the invention, and said that they had been using it for years; but no proofs, however, were brought forward to substantiate their assertions. The friend from whom I had the earliest information about the matter told me the following anecdote in connection with its origin:—In one of the American cities there was a certain medical electrician, or galvanist, who professed to cure all kinds of diseases, and to remove all sorts of pain, by means of electricity. One day he was applied to by a man who was dreadfully tormented with toothache, and wished to be relieved from his pain. For this purpose, a wire from each pole of an electrical machine, terminating in a metal disc covered with a piece of moistened sponge, was

applied to each cheek, without however producing any mitigation of the symptoms; and, after various trials with like unsuccessful results, the galvanist thought of applying it more directly to the tooth itself, and, with this object, he attached one of the wires to a pair of forceps, which exactly fitted the offending masticator, keeping the wire, which was attached to the opposite pole, to the cheek. Feeling uncertain whether he should be able to remove the pain, and having just then a fast hold of the tooth, the temptation to remove it was so great that he extracted it without saying a word to his patient, who, when it was out, declared that it was removed without pain. I have no doubt the discovery must have been made in some such way.

When first apprised of electricity being used for the purpose of producing local anæsthesia, I had never heard of Mr. Francis or his *modus operandi.* The only information I had was from my friend in America, and was contained in these words:— "They are drawing teeth on this side of the water, without pain, by means of electricity." I thought this might be deserving of notice, and having by me a magneto-electric machine, which I had purchased more as a philosophical toy than for any other purpose, I began to consider how to proceed, and having procured some copper wire, I attached one of the poles, having a metal disc upon it, to the spine and the other to the tooth

and gum of a patient, and extracted the tooth, whilst the current was flowing. Operations so conducted were unsatisfactory and cumbrous, as, with the machine I then used, two assistants were necessary, as well as the operator. My next idea was to attach the wire to the forceps, which plan I immediately adopted and have hitherto continued. My experiments were made at first upon poor and, in many instances, ignorant people, and, when asked if they felt anything, they invariably answered in the affirmative. Not bearing in view at the time the distinction between sensation and pain, I concluded that they were failures; feeling, however, assured that, had those made in America really succeeded, there would be an account of them in the *Dental Journal*, published in that country, and which, for many years, was the only medium exclusively devoted to dentistry which the profession in this country could obtain, I waited for its appearance before proceeding further, and received it about the time when there was so much congratulation in this country and so much rejoicing on the opposite shores of the Atlantic on account of the apparent success with which electricity had, for the first time, been enabled to whisper secrets through two thousand miles of submerged cable. After successfully repeating my experiments upon three gentlemen, on whom I could place the greatest reliance (which experiments I know now were the first made in

this country), and looking upon the subject more from a scientific than a professional point of view, I endeavoured to make the matter public, with the view of finding out if any other members of the profession were engaged in similar inquiries, so that I might communicate with them for our mutual assistance. I therefore sent to some of the principal newspapers in Cheshire, and the surrounding counties, a paragraph on the subject from the American *Dental Journal*, accompanied by a short explanatory note from myself; but, somewhat to my disappointment, I did not succeed, at that time, in calling the attention of the profession or the public to the discovery.

In the mean time I continued experimenting with a success that astonished me. I must say that I was fairly puzzled. The evidence given was so strange, of so entirely new a character, yet at the same time so unmistakable, that I could not doubt that a local anæsthetic had been discovered. In order to get as fair a case as possible, I persuaded my youngest son to have a temporary molar tooth removed, and he fully confirmed what others had asserted by exclaiming, "That's the thing; it will do, papa!" My cook, who greatly dreaded the extraction of a tooth, had been suffering for some days with toothache, and, upon hearing my son's testimony, asked me to remove one for her. After the operation she told me she felt no pain: "she would assure me she

felt no pain." Including private, hospital, and gratuitous patients, I had by this time extracted nearly two hundred teeth with the assistance of the electrical current, so that when I read in the *Times* the account of a melancholy accident from chloroform at Epsom, which at the time created a profound sensation, I felt it was a duty I owed to society to make known the results of my experiments. I therefore determined to send them to the editor of that journal. I need only say that one spark from that great battery electrified the whole of Europe, and numerous individuals, in this country and on the Continent, commenced experimenting.

I have no doubt that a wish to give mutual aid originated the various directions that were given, some good, others indifferent, many erroneous, and all, from the novelty of the subject, necessarily crude. Electrical machines were made and sold of every imaginable form, possessing power sufficient to knock down a bull, but without the means of diminishing the intensity of the force to that gentle current upon which, I believe, success in using it as a local anæsthetic in dentistry depends. It cannot, therefore, be a matter of surprise that persons practically unacquainted with electricity, by following such directions and using such machines, should have failed in their operations. These failures excited discussions; letters for and against the subject were published

in the medical and dental journals, facts were brought forward to prove the efficacy of the new agent, and metaphysical treatises were written to prove the thing impossible. Then a meeting of the College of Dentists was called, which was crowded to suffocation, "to discuss the question whether electricity had the power of deadening pain." In the *Times* of October 14th, 1858, may be found a report of that meeting, in which it is stated that the president "passed in review the various methods by which electricity might be applied, with the intention of rendering the extraction of teeth painless; but, unhappily, the results of his own experience did not warrant him in stating that so desirable a condition had as yet been attained; on the contrary, he believed that the attention being arrested, and the mind occupied by the power of anything as novel as electricity, would sufficiently explain the power which that agent occasionally possessed to somewhat mitigate the pain. Several other gentlemen corroborated this conclusion by the results of their own experience."

I can quite understand why the president and his coadjutors failed to obtain satisfactory results. A few days before that meeting was held, a machine was sent for my inspection with these printed directions,—"One part of sulphuric acid to be mixed with thirty parts of water." I followed the directions, and when I completed the circuit, by

grasping the handles attached to each of the poles, I thought every joint in my body would have been dislocated, and I had great difficulty in letting the handles drop. During the day I experimented with the machine, and, after numerous trials, found that the nearest approach to a proper current was produced when one part of acid was mixed with 128 parts of water, and even then the current was too strong; but upon further diluting the acidulated water there was not sufficient energy to work the machine. It can easily be conceived that electricity applied to a tooth from such a battery would not only not deaden pain, but would produce such an aggravation of it that the mere extraction of a tooth would be comparatively nothing. The mind would indeed be occupied, and I doubt not that such an application of electricity for deadening pain would be considered novel.

This, however, is not the manner in which electricity is to be used in order to obtain successful results. The mind need not be occupied with the application, nor is cognizance of it even necessary. My arrangements, which will be explained presently, are such that the patient may take his seat, and have the tooth extracted, not only without pain, but, as the apparatus is concealed, may be absolutely unaware that electricity is being employed. As an instance, a railway porter, who had been confined to his bed with

fever for six weeks, and was in a very debilitated state, called upon me to have a tooth extracted. He took his seat and I removed the tooth. "There, my man," I said, "that will do." "It is not out, is it, sir?" exclaimed the man. "Yes, here it is," showing him the tooth. "Well," said he, "you are the cleverest man I ever met with. I did not think it was out." "You have heard," I said, "that we can now take out teeth by electricity without pain, have you not?" "No, sir; I have been ill so long that I have not heard what is going on." Now this man had never heard of the employment of electricity, was told nothing about it, and had his tooth taken out without knowing anything more than that it was painlessly removed. This one fact, in my opinion, completely nullifies the President's theory. Now for other proofs of the power of electricity to deaden pain. It was necessary for me to remove from the mouth of a lady ten teeth, chiefly incisors and bicuspids, in order to prepare the mouth for a complete artificial set. I extracted three with the aid of electricity, and my patient sat quite still. I asked her whether the operations hurt her. She said they did. I then inquired whether she experienced as much pain as when she had her teeth removed in the ordinary way. She said, "I can't tell," and seemed disinclined to say anything in its favour. In fact, all her verbal testimony was of so conflicting a character

that I determined to remove the next tooth without electricity, and to watch her countenance, to see whether there was any indication of increased pain. As soon as I grasped the tooth there was an agonized expression which I had not observed while removing the other three; and when the tooth was out she jumped from the chair, put her hand to her mouth, and uttered moans, as if in great pain. When she had somewhat recovered I told her that electricity had not been used in that instance. She begged to have it used to the others, and with its aid the remaining six were removed in less time than was lost by the pain occasioned by removing the single one without it. A lady of rank, residing in the Principality, and who had never had a tooth removed, called upon me for the purpose of having two upper molar teeth extracted. The first was removed without electricity, and she described the pain as dreadful. The other was removed with electricity. I made a note at the time *verbatim* of what she said, as I then always did when electricity was used. When asked what she felt, she replied, "There was no pain: the sensation was curious, but there was no pain."

The question may be asked, Have you never any failures? I answer candidly, Many—three or four in every twenty operations. I will relate one or two. I not long since removed from a gentleman two teeth with electricity, and two

without its aid. He preferred being operated upon without: the feeling of the electricity, he considered, was worse than the pain of extraction. The teeth were all more or less loose. A few days since I removed for a youth two lower molar teeth, and he said the pain was not lessened, although all the known necessary conditions were apparently complied with in his case. A girl had an upper bicuspid tooth removed, and she also complained that the pain was very great; but in this instance a friend who accompanied her observed that she lifted her hands from the conductors, and, in fact, did not get any electricity. A similar case was that of a clergyman who had an upper wisdom tooth removed. He said the pain was greater than he had ever previously experienced, and I had extracted several for him on former occasions. The cause of failure in this instance was traced to the fact that, at the moment of extraction, the external wall of the tooth gave way, and the beak of the forceps was plunged into the pulp. In many such instances I have been able to discover similar reasons for my want of success in special cases.

Up to the present time operations have been performed in a very imperfect manner, owing to the want of more extended inquiry, of properly constructed electrical machines, and of insulated forceps. Yet sufficient has been done to warrant a still closer investigation, and to lead me to

hope that at no very distant period we shall attain much greater efficiency, and be able to calculate with more certainty under what circumstances, on what constitutions and peculiar temperaments, electricity is likely to act favourably. For although it may not be *invariably* successful as an anæsthetic, I maintain that it is so even now in the majority of cases, and possesses this great advantage, that it may be used in dentistry when chloroform or nitrous oxide would evidently be dangerous. The following case, which to me was particularly interesting, will be a good illustration :—A young gentleman, 12 years of age, whose health had been greatly impaired, first from having had brain fever, and afterwards from concussion of the brain arising from a fall from a pony, which had rendered him insensible for a considerable period, was brought to me to have two permanent lower molar teeth removed, which were decayed and giving him pain. He was too delicate to be operated upon without an anæsthetic, and, under the circumstances, his medical attendant would not for a moment advise the use of chloroform. His friends, therefore, determined to have recourse to electricity. On taking his seat I removed one tooth; he then stood up, washed his mouth, and smiled at his mother. In less than a minute, without the slightest reluctance, he submitted to have the other tooth removed, which was effected without his giving

any indication of pain, either by expression or by the utterance of any exclamation. The following note, which I received a few days after the operation, in answer to inquiries upon the subject, will show the estimation in which it is held by the lady who witnessed it, and to whose son the result was of so much importance :—

"Dear Sir,—I have much pleasure in bearing my testimony to the complete success of your application of galvanism in extracting my little boy's two teeth. He is so nervous and sensitive a child, and his teeth are so large and strong, that we much dreaded the effects of a severe operation, and our medical adviser entirely disapproved of chloroform for him. Under your treatment he felt *no pain—nothing* (as he described it) *but the 'hard tug.'* Hoping, for the good of society in general, that the system may become more known and practised,

"I am, dear sir,

"Yours faithfully,

——— ———."

That electricity possesses great anæsthetic powers I am certain, and, as observed before, the want of success, in by far the greater number of cases, results from some imperfection in its administration. In some instances the apparatus ceases to act at the moment of extraction; in others there is either something wrong in the

wires, or else the patients lose hold of the conductors. Again, many cases which are said to be painful are in reality nearly painless. Sensitive patients, when not completely unconscious—that is, when not entirely divested of feeling—will often exaggerate, and call that pain which other persons would hardly consider more than a disagreeable sensation.

I have now given you a few of the results of my early use of electricity, and, if not trespassing too much upon your time, I shall briefly describe the *modus operandi* by which they were accomplished. The first electrical instrument I used, and which is the one I have with me, was one of Davies and Kidder's patent American electro-magnetic machines, which I happened to have by me at the time. The only objection to it was that a servant was obliged to be present in the room to turn the handle of the instrument. This seemed to make so much fuss, and had such an appearance of charlatanry, that I was glad to substitute for it a little instrument kindly brought to me by Dr. Reid from Edinburgh, which answered very well while it did act, but so often ceased in the midst of an operation that I was compelled to abandon it. Another was tried with similar want of success. At last I procured a couple from a medical electrician then residing in Chester, which answered better that any I had previously used, and one of these I took to Messrs. Ash &

Sons, who had some made after the pattern. These seemed to answer very well when brought only into use occasionally, but when constantly employed became difficult to manage. By having several of them at hand, I had always one in working condition. Upon leaving Chester for Liverpool, from some cause or other all the machines became invalided and not one of them would work. I was here required to use electricity more frequently, and was therefore obliged to fall back upon Davies and Kidder's machine, which is always in order and ready for use. To do without the presence of the servant in the room, I had a shelf arranged outside my operating room, and so out of sight. On this the machine is placed, so that its presence, as well as that of the servant, is banished from view. Wires from the machine to the chair, a distance of eight or ten yards, are conveyed along the sides of the walls and under the carpet, so that there is literally nothing to be seen, as the little metal cord used to attach the forceps hangs imperceptibly behind the chair. And I can assure my hearers that many, having heard of the wonders of electricity, are sadly disappointed at not seeing the apparatus of a conjuror in the room, and, like Naaman the leper, are vexed when they find the prophet does not "do some great thing." This method of using electricity is decidedly the best, as the machine is always

ready, and the instruments, carpets, and furniture are not liable to be injured by acid. In the left-hand corner of the box containing the electro-magnetic machine there is a sliding rod, which controls the position of the straight armature in relation to the poles of the magnet, and by moving this on or off the poles the strength of the shocks may be regulated. Nevertheless, when the short conducting wires that are sent with the machine are used, the most mitigated current that can be obtained from it is too strong for use in electro-dentistry. But, in my desire to remove the instrument and anything that might attract attention from the room, I was obliged to use long wires, and these, being only roughly insulated with cotton thread, I found by practical experience produced exactly the degree of strength of current best adapted for my purpose, a certain amount of electricity being doubtless lost in the transit between the machine and the operating-chair. It may here be mentioned that when the wires are carried under the carpet, they must not be allowed to cross each other, as the cotton thread which insulates them would soon be worn away, and the circuit completed before the chair was reached.

Proceeding to the operating-chair, the extremities of its arms are covered with thin metal plates, and a copper wire attached to each of these plates runs round the chair, to which one

of the conductors from the electrical machine is attached, while the other joins on to a flexible metal cord, which during an operation is fastened to the forceps. Care should be taken that this metal forceps cord should be properly insulated, as if it is not so, and happens to come in contact with the metal plates on the chair, the current will be suspended. When an operation is to be performed, the patient takes his seat, the head is properly adjusted, and the hands are placed upon the metal plates which cover the arms of the chair. The forceps being firmly applied, that moment the circuit is completed, and the tooth should be removed as quickly as possible, but *without hurry*.

During the first few months I experienced great inconvenience, owing to the difficulty of getting forceps properly insulated. Every method that could be thought of by a great number of artizans whom I consulted was tried without success. When almost despairing of attaining my wishes, I remembered that one of my boyish amusements was to make gold lacquer, and with it varnish any article made of tin that I could lay hands on : shellac, one of the component parts of the lacquer, I knew to be a nonconductor of electricity. I immediately applied to a gasfitter, a most intelligent man, and explained to him my wants. He comprehended the thing at once, and, with his assistance, I had the satisfaction

of finding that when the beaks and bright parts of the blades of the instruments had received about six thin coats of the lacquer they were perfectly insulated, and their appearance was only altered by those parts being changed from a bright steel colour to that of a deep straw. To have my instruments always in order, I have had made a little sheet-iron box oven, one side of which opens like the lid of a box. This is heated over a gas-stove, and a small piece of wood is placed upon the bottom for the beaks of the forceps to rest upon whilst being heated. Every particle of grease and dirt being removed from them, several pairs are placed in the oven to be heated until with difficulty they can be held with the fingers, and, while still warm, a thin coating of gold lacquer is given them by means of a camel-hair brush. The forceps are then allowed to get quite cool, and are again heated and varnished, and this operation is repeated about half a dozen times. They must never be made so hot as to cause the varnish to boil, or the effect will be spoilt. I need scarcely observe that the inner surfaces of the points of the forceps must not be insulated, as it is through them that the electricity is conveyed to the tooth. It sometimes happens that by constant use the lacquer used for insulating the blades of the instruments gets imperceptibly abraded or worn away in little spots. Should any of these unprotected places

touch the lips, they feel like so many heated points; it is necessary, therefore, to have the forceps constantly and carefully examined and remedied in this respect, and it is also a very good plan to protect the lips with a napkin.

Having thus described my method of operating, I would again wish it to be clearly understood that, in advocating the use of electricity, I do not do so with the view of drawing a comparison between the anæsthesia produced by it and the more perfect form produced by such agents as chloroform or nitrous oxide gas. As I stated at the beginning of my paper, I have been induced to lay before you these remarks by the conviction that there is still scope for the use of some anæsthetic which, though not so infallible in action as those just mentioned, is at least free from many disadvantages which we must all acknowledge they possess.

And now my tale is told. I claim for it no literary merit; for the subject, no novelty; for its author, no originality. The only claim I make I have received, in the satisfaction of having explored an interesting region of science, discovered and traversed by former pioneers; and if in my wanderings I have stumbled upon any nook or corner of interest overlooked by them, to the best of my ability I have mapped out the course I have taken, in the hope that it may induce abler and younger

men to continue the exploration, provide us with better charts, and lead us by a nearer road to the goal we are all aiming at—the mitigation of human pain.

Discussion.

The President.—On a former occasion we have had the subject of electricity as an anæsthetic described by Mr. Snape, and the incidents now communicated must have afforded interest to this Society. The application of electricity for the extraction of teeth has evidently proved beneficial to many, as we may gather from the expression of feeling recorded in the numerous letters written by Mr. Snape's patients, and read to us this evening. The subject would perhaps have been better supported by an exact record of the symptoms exhibited, and we should also be glad to know more of Mr. Snape's mode of operating with this agent. Has he used it for lessening the sensitiveness of the dentine, which, in the operation of filling, is often more difficult to deal with than the sharper but shorter pain of extraction, and with what result? I find that our observations must necessarily be brief, as we have already approached the hour when this meeting must close.

Mr. Sewill said that if, on the one hand, electricity were an anæsthetic to be relied upon in dental operations, or if, on the other hand, the conclusions at which Mr. Snape had arrived were fallacious, it was equally desirable that the fact should be authoritatively confirmed on that occasion by the Society. It would be to be regretted if the question which Mr. Snape had come so great a distance to put before them were not thoroughly discussed, and, as there appeared some hesitation in commencing the debate, he rose to express the opinion which he had formed in the matter. He had performed experiments upon himself, and upon a scientific friend well versed in physiological experiments, and from them he was satisfied that, no matter whether powerful or weak, or in what way applied, the galvanic current was in no sense anæsthetic,—that it did not destroy sensation nor mitigate pain. There were no special circumstances in the extraction of a tooth which rendered it probable that

the operation would be rendered painless by a process which failed to prevent pain in other parts of the body. But he was well acquainted with Mr. Snape's mode of using electricity, and had employed it in a considerable number of extractions ; and the result of these operations was to confirm the opinion formed from the preceding experiments. He believed that in a considerable number of cases of tooth-extraction the patient would declare that he felt no pain, and indeed might really be unconscious of suffering, if his mind were distracted at the time of the operation by some novel sensation or by some mysterious process. This was more especially the case in the nervous and hysterical. Such patients often pondered for weeks over a trivial operation, and when, at length, it was performed with the infliction of but little pain, they were ready to attribute the mitigation of the anticipated suffering to the agent employed. Here was the source of Mr. Snape's fallacy, and he was convinced that if Mr. Snape would carry out some experiments upon the lower animals or upon men who would calmly watch their sensations, he (Mr. Snape) would be induced to modify the views which he had formed from the testimony of suffering patients. Whilst thus differing from Mr. Snape, he would not detract from the obligation which the Society doubtless felt themselves under to him for having come so many miles to read his paper at that meeting.

Mr. Bennett.—About ten years ago, at the time that the application of electricity for dental operations was exciting a great deal of interest in the public mind, I had an opportunity of trying its effect at one of the London hospitals, and kept a record of more than one hundred cases. I used several kinds of apparatus, and batteries of various strengths. In some cases I was very successful ; two in particular I will mention. The first was the removal of a left upper bicuspid for my own brother : the tooth was firm, and the root much inflamed. He told me he felt no pain. In the second case I removed a left upper canine root without the current ; the right one, with. The patient said she would rather have electricity used if ever she had another tooth extracted. Shortly after I had to remove the two upper centrals for the same lady, using the

battery. She seemed in a state of stupor for about half a minute after the operation, and said she had not felt any pain. It seemed to me that the absence of pain might be due to the mind of the patient being prepared for some novel effect, and that the nerve-force was diverted. With the apparatus I used, one end of the secondary wire terminated in a hollow metallic cylinder held in the hand of the patient, the other being connected with the forceps, which were held in my hand, on which I wore a silk glove as an insulator. When the forceps were adjusted, the circuit was completed by placing my foot upon a spring footboard. The patient I first tested was a young man about 19, and the tooth to be removed was a first lower molar, left side. When all was ready, the cylinder in the patient's hand and the glove on mine, I extracted the tooth without placing my foot on the board, so that no current passed. The patient declared he felt no pain. Afterwards, when the novelty passed off, I was less successful, and therefore discontinued its use, as it was much more convenient to operate without it.

Mr. Cattlin.—I wish to ask Mr. Snape, before he closes his reply, whether in all cases where acute periostitis was present the pain was not increased by electricity? I used electricity frequently some time ago by means of Mr. Header's machine, which did not allow the current to be modified in the manner described by Mr. Snape. In many cases the pain substituted for the usual pain of extraction was by far more agreeable to the patient, but in every case where acute periostitis was present the pain was greatly increased by electricity.

Mr. Snape.—In reply to the inquiry of the President, I may say I have not used electricity for the purpose of rendering dentine less sensitive, nor do I think it capable of effecting so desirable a result, applied, as I use it, for tooth-drawing. When I first proposed to read my paper before this Society, I hoped to be able to remain over the night, and give practical demonstrations at the Hospital the following morning; but I regret to say I am compelled to return to my home this evening. But on some future occasion I hope to be able to carry out this part of my programme. In reply to the last inquiry, I

have only to repeat what I have stated in the body of my paper, viz., that in such cases electricity does not appear to afford the relief it does when the teeth are firm and free from inflammation.

The PRESIDENT.—I must beg Mr. Snape to accept the thanks of the Society for the communication read by him this evening. Although many are disposed to doubt the efficacy of the agent which he recommends as an anæsthetic for the extraction of teeth, yet I can hardly imagine that it can have been employed by him in practice for so many years and in so many cases without possessing more than a passing claim to our notice. We may doubtless be easily misled in investigating these and similar subjects, when we depend for our facts upon the statements of patients more or less nervous. I hope that at some future meeting Mr. Snape may be induced to give us the result of further experiments made with the view of testing more severely the value of electricity as an anæsthetic. This, gentlemen, is the last meeting of the present session, and whilst congratulating the Society upon the papers which have been already read, I think we may claim for them the character of being practical, tending as they have done to raise discussions upon those subjects of importance which come before us in daily practice. I trust that the interval between this and our next meeting, in November, may afford opportunities for the production of papers of an increased scientific character, so that at the close of the official year our "Transactions" may be in no respect inferior in interest to those of preceding years.

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